

Land Use Planning

For Small and Medium MPOs

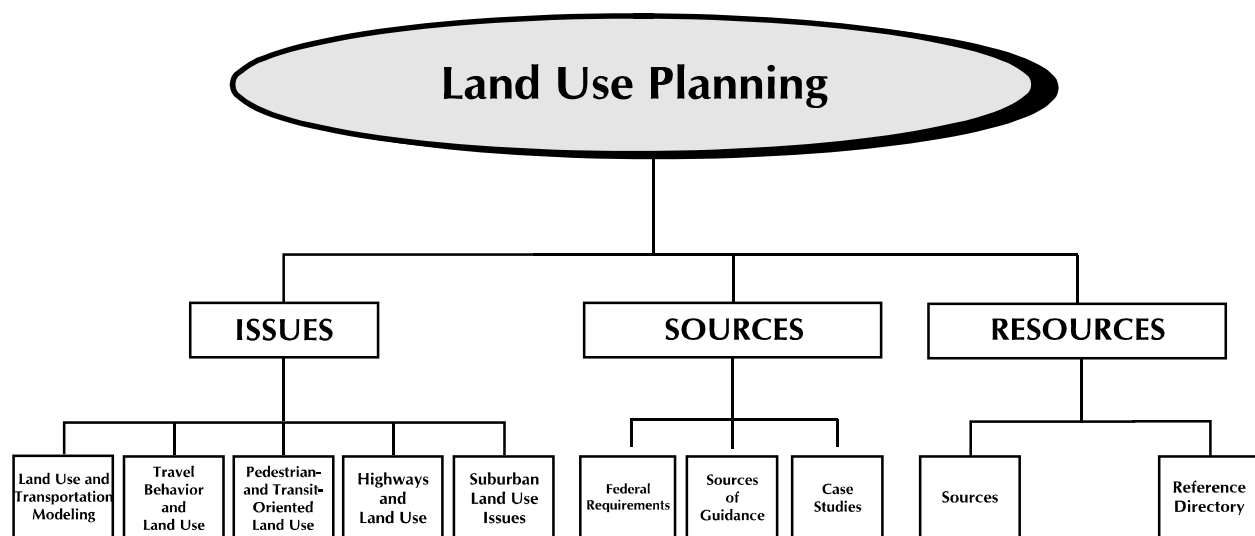
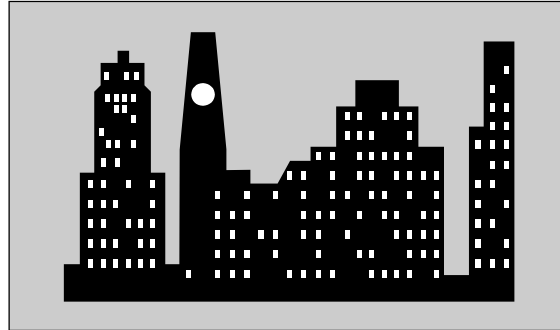


Table of Contents

I. INTRODUCTION	7
A. MPOs and Land Use Planning	7
B. Approach and Organization of Land Use Planning Guide	8
II. ISSUES OUTLINE	11
A. Land Use and Transportation Modeling Issues	13
B. Travel Behavior and Land Use	14
1. Travel Demand Management Programs	14
2. Congestion	14
3. Auto Ownership	15
4. Non-Work Trips	15
5. Parking Policies	15
6. Reducing SOV Travel	15
C. Pedestrian- and Transit-Oriented Land Use Issues	15
1. Site Design	16
2. Neighborhood Development and Corridor Strategies	16
3. Regional Smart Growth Strategies	17
D. Highways and Land Use	19
1. Urban	19
2. Rural	20
E. Suburban Land Use Issues	20
III. SOURCES OUTLINE	21
A. Federal Requirements Relating to Land Use Planning	23
1. Existing ISTEA Requirements	23
2. New Requirements	25
B. Sources of Guidance	33
1. ULI on the Future: Smart Growth	33
2. Smart Growth and Neighborhood Conservation	34
3. Why Smart Growth: A Primer	34
4. Moving Beyond Gridlock: Traffic and Development	35
5. Transit-Supportive Development in the United States	36
6. Guidelines for Transit-Sensitive Suburban Land Use Design	38
7. Guide to Land Use and Public Transportation, Volume I	38
8. Guide to Land Use and Public Transportation, Volume II	39
9. Effects of Land Use and TDM Strategies on Commuting	41
10. Short-Term Travel Model Improvements	43
11. TMIP Land Use Modeling Conference Proceedings	44
12. TMIP Conference Proceedings	45
13. Urban Design, Telecommuting, and Travel Forecasting Conference Proceedings and Papers	46

Land Use Planning ■

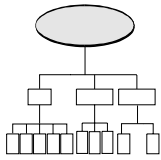
14.	Green Development	48
15.	Impact of VRE on Land Use in Northern Virginia	49
16.	Design for Efficient Suburban Activity Centers	53
17.	Integrating Transportation and Land Use Planning	54
18.	Investigation of Land Use, Development, and Parking Policies to Support the Use of HOVs in Texas	56
19.	Effects of Roadway Improvements on Land Use and Traffic	56
20.	Land Value and Land Use Effects of Elevated, Depressed, and At-Grade Level Freeways in Texas	57
21.	Dallas Area Rapid Transit Impact Study: A Framework for Assessing Land Use and Development Impacts	58
22.	Using Historical Data to Measure Transportation Infrastructure Constraints on Land Use	59
23.	A Technical Review of Urban Land Use	60
24.	Transportation, Urban Form, and the Environment	64
25.	Expanding Metropolitan Highways	67
26.	The Relationship Between Transit & Urban Form	70
27.	Land Development Regulations & Access Management . .	74
28.	Transportation System and Land Use Management	77
29.	Transit-Friendly Streets	78
30.	The Costs of Sprawl — Revisited	80
31.	Transit and Urban Form, Volume I	81
32.	Transit and Urban Form, Volume II	95
33.	Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas	97
34.	Relationships Between Land Use and Travel Behavior in the Puget Sound Region	102
35.	Transportation and Economic Development	104
36.	Interstate Highway System: Reshaping Nonurban Areas of Pennsylvania	108
37.	Interstate Highway Interchanges as Instigators of Nonmetropolitan Development	108
38.	Parking Restrictions in Employment Centers	109
39.	Transportation Sketch Planning with Land Use Inputs . .	109
40.	Regional Versus Local Accessibility: Implications for Non-Work Travel	110
41.	Travel Characteristics for Neotraditional Designs	110
42.	Transit-Based Housing and Residential Satisfaction	111
43.	Light-Rail Transit Stations and Property Values	111
44.	Transportation, Congestion, and Density: New Insights .	112
45.	Urban Form and Pedestrian Choices: Study of Austin Neighborhoods	112
46.	Transit-Oriented Development in the Sun Belt	112
47.	Land Use Impacts of the Houston Transitway System . .	113

Land Use Planning ■

48.	Suburban Transport Behavior as a Factor in Congestion	114
49.	Role and Function of Transit in Growth Management . . .	114
50.	Land Use and Transportation Planning in Response to Congestion Problems: A Review and Critique	115
51.	Decentralization of Jobs and Emerging Suburban Commute	116
52.	Location Planning for Companies and Public Facilities . .	117
53.	Factors Affecting Automobile Ownership and Use	117
54.	Residential Density and Travel Patterns	118
55.	Impacts of Mixed Use and Density on Utilization of Three Modes of Travel	118
56.	Effect of Neotraditional Neighborhood Design on Travel .	119
57.	Land Use Transportation Models for Policy Analysis	120
58.	Impacts of Commuter Rail Service as Reflected in Single- Family Residential Property Values	120
59.	The Effect of Future Trends on Trip Patterns, Urban Commercial Structure, and Land Use	121
60.	Effects of Freeway Stage Construction on Nearby Land Uses and Vehicle User Costs	121
61.	Evaluation of Economic and Development Impacts of Major Transit Investments	122
62.	Evaluation of Two Residential Models for Land Use Allocation	122
63.	Land Use-Transportation Analysis System	123
64.	Work Location Estimation for Small and Rural Areas . . .	123
65.	Shaping a Suburban Activity Center Through Transit and Pedestrian Incentives: Bellevue CBD Planning Experience	124
66.	Land Use Changes in Suburban Clusters and Corridors .	124
67.	Defining Regional Employment Centers in an Urban Area	125
68.	Living on the Edge: Costs & Risks of Scatter Development	125
69.	How Sprawl Costs Us All	126
70.	Ahawahnee Principles: Toward More Livable Communities	129
71.	Livable Communities Initiative	138
72.	Walkable Communities: Twelve Steps	143
73.	Effects of Site Design on Pedestrian Travel in Mixed Use, Medium Density Environments	147
74.	Land Use/Transportation Scenario Testing	149
75.	Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions	150
C.	Case Studies	157
1.	Integrating Land Use and Transportation Decisions	157
2.	Impact of Land Use Strategies on Suburban Mobility . . .	158
3.	Route 1 Corridor in Danvers: A Land-Use Study	165
4.	Transportation and Land Use	168
5.	Chicago Enhanced Planning Review	170

Land Use Planning ■

6.	Dallas Enhanced Planning Review	175
7.	Honolulu Enhanced Planning Review	176
8.	Miami Enhanced Planning Review	179
9.	New Orleans Enhanced Planning Review	183
10.	Northern New Jersey Enhanced Planning Review	184
11.	Philadelphia Enhanced Planning Review	188
12.	Salt Lake City Enhanced Planning Review	197
13.	San Francisco Enhanced Planning Review	201
14.	Seattle Enhanced Planning Review	204
15.	Washington, D.C., Enhanced Planning Review	207
IV.	RESOURCES	211
A.	Sources	213
B.	Reference Directory	229



INTRODUCTION

A. MPOs and Land Use Planning

Transportation and land use must not be viewed in isolation. They interact and relate to many issues of import for communities. Transportation plans and programs, cognizant of salient local land use issues and in cooperation with other government agencies and the private sector, can make communities better places to live. At the most fundamental level, transportation and land use planning answer the same questions: ***how does our community grow and what do we want our community to become.*** The International City/County Management Association (1998) expresses the challenges facing many small and medium sized areas:

Across the country in large metropolitan areas and rural towns alike, growth and development are receiving increased attention. Growth patterns are linked to a community's success in providing quality schools, relieving traffic congestion and air pollution, controlling taxes, and providing economic opportunity. . . . Successful communities have a vision of where they want to go and of what things they value in their neighborhoods and downtown areas. Their plans for development reflect these values and answer questions facing communities nationwide. How can a community capture the benefits of growth without overcrowding its schools? How can a community maintain its small-town charm and character while accommodating new residents and prospering economically? How can a community, city, or suburb benefit from growth but not suffer the post-growth disinvestment that so often follows.

Land use planning works on three levels: regional decisions about urban form, the uses of land within neighborhoods or corridors, and site level urban design decisions. Different stakeholders and decision-makers exist at each level. For MPOs, the “3C” process applies to land use planning with equal valence as other activities. The built environment is dynamic, and to be effective, land use planning must be ongoing. To establish a comprehensive and cooperative process, MPOs should establish good working relationships with land use decision-makers.

ISTEA makes explicit the importance of considering land use in the metropolitan transportation planning process. Planning Factor 4 (23 U.S.C. 134(f)) requires MPOs to consider “[t]he likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans.”

TEA-21 condenses ISTEA’s planning factors into seven general factors. The consideration of land use is implicit in several of these factors. MPOs

are required to consider projects and strategies that will support the economic vitality of the metropolitan area and increase accessibility and mobility options available to people. They must also consider projects and strategies that protect and enhance the environment, improve quality of life, and enhance the integration and connectivity of the transportation system. The explanatory materials for TEA-21 (U.S. House of Representatives, 1998b) make clear that "...metropolitan planning organizations are encouraged to consider the interaction between transportation decisions and local land use decisions appropriate to each area."

Considering, in the planning process, relationships among land use and all transportation modes potentially impacts many activities of an MPO. Effective travel demand forecasting depends on land use forecasts. Long range transportation plans should consider regional and/or municipal land use plans and metropolitan development objectives. Creating and attaining metropolitan quality of life goals depends, in part, on land use strategies. New Starts projects are evaluated based on criteria including land use policies. Major investment studies must consider land use and economic development. Air quality models and goals depend on land use forecasts and plans. The effectiveness of congestion management and travel demand management strategies depends on land use and development. Public involvement efforts should consider the public's desires for urban form and land use. The effectiveness (in terms of accessibility and mobility) of transit capital improvements and highway capacity enhancements may depend on land use and development. In numerous other ways, land use affects the activities of MPOs.

B. Approach and Organization of Land Use Planning Guide

This section is designed to offer MPOs a primer/anthology on land use planning. It provides a schema for understanding relevant issues and directs readers to documents and other resources that illuminate salient topics. These issues may require immediate action in the reader's community. However, this section is also intended to make readers aware of issues that, while not currently considered, may be appropriate to include in the metropolitan transportation planning process. The land use planning section is composed of three parts:

- **Issues Outline**

This part serves as an index that links major issues associated with land use planning for MPOs with various sources of guidance and information. These topics include land use and transportation modeling issues, travel behavior and land use, pedestrian- and

transit-oriented land use issues, highways and land use, and suburban land use issues.

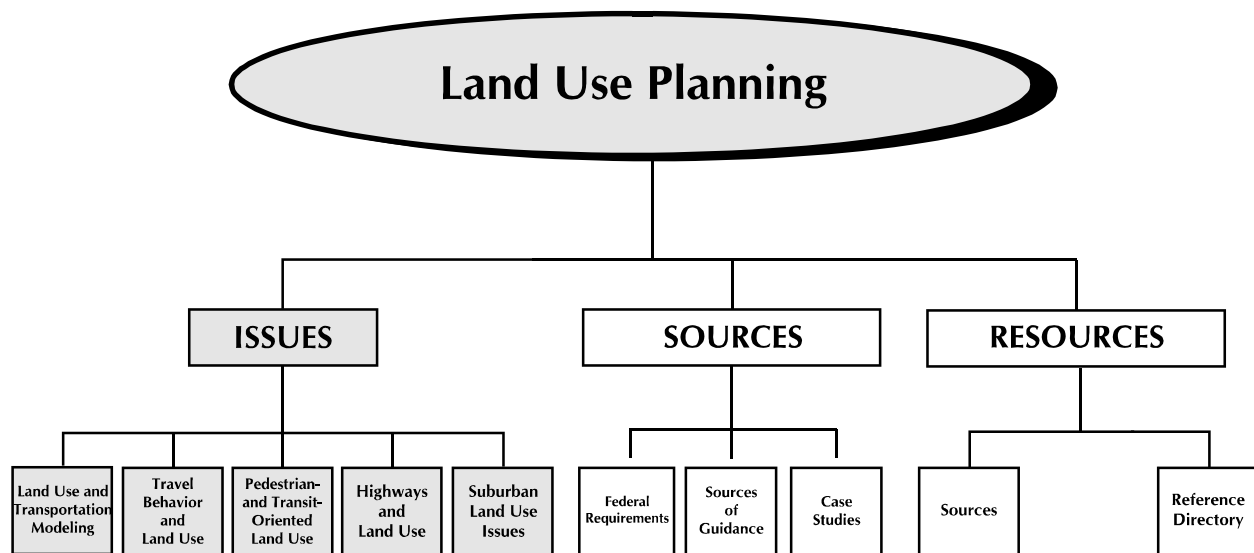
- **Sources Outline**

This part provides excerpts and summaries from the Federal land use planning requirements for MPOs, 75 sources of guidance for land use planning, and 15 case studies.

- **References**

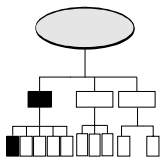
This part includes a sources bibliography and a reference directory. The sources section provides bibliographic information plus information on how to obtain source material. The reference directory provides a listing of national and regional organizations which have additional information that may assist MPOs in better understanding land use planning.

Issues Outline



ISSUES OUTLINE

This section serves as an index that links the major issues related to land use planning with various sources of guidance and information. The major land use planning issues relevant to MPOs (land use and transportation modeling, travel behavior and land use, pedestrian- and transit-oriented land use issues, highways and land use, and suburban land use issues) are presented below in outline form, with links to locations in the sources outline. Sources beginning with “B” are guidance documents, and sources beginning with “C” are case studies. For each issue, links are listed in order of the sources outline. The text of Federal laws and regulations applicable to land use planning for MPOs is given in part “A” of the sources outline.

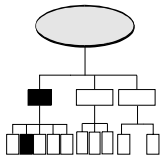


A. LAND USE AND TRANSPORTATION MODELING ISSUES

Current literature identifies a common need for MPOs to more explicitly and accurately recognize the complex relationships among urban form, land use, urban design, and travel demand in the modeling process. Sources in this section examine current land use-transportation modeling methodology and improvements to the traditional urban travel demand modeling process. These sources address issues such as land use allocation techniques, incorporating urban design variables in travel demand models, and measuring transportation infrastructure constraints on land use. Some specifically discuss applications to small urban and rural areas.

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| (11) | B62 |
| (12) | B63 |
| (13) | B64 |
| (14) | B74 |
| (15) | C1 |
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- (22) C15



B. TRAVEL BEHAVIOR AND LAND USE

A substantial body of research and literature examines the relationships between land use and aspects of travel behavior and discusses how municipal/regional policies can support or undercut each other. Although experts disagree about the intensity of these relationships, it is undeniable that land use and travel behavior interact, and that MPOs must work with local governments to thoughtfully develop consistent policies and programs that support metropolitan goals. This section will direct the reader to information about the relationships between land use and travel demand management programs, congestion, auto ownership, non-work trips, parking policies, and reducing single-occupant vehicle travel.

1. Travel Demand Management Programs

- (1) B5
- (2) B9
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2. Congestion

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- (5) B26
- (6) B32
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- (8) B44
- (9) B48
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- (11) B53
- (12) B74
- (13) B75
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3. Auto Ownership

- (1) B34
- (2) B46
- (3) B53

4. Non-Work Trips

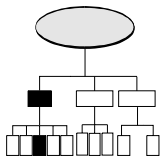
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5. Parking Policies

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- (4) B65

6. Reducing SOV Travel

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- (8) B31
- (9) B34
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- (11) B55
- (12) B56
- (13) B65
- (14) B70
- (15) B75
- (16) C2
- (17) C5



C. PEDESTRIAN- AND TRANSIT-ORIENTED LAND USE ISSUES

Recently, the rise of the Smart Growth and New Urbanism movements have raised the Nation's awareness of pedestrian- and transit-oriented land use issues. These movements have brought together a diverse coalition of planners, developers, environmental experts, transportation professionals, government officials, and community leaders who have articulately and powerfully advocated the importance of these issues to communities of all sizes. ISTEA stressed the importance of a multimodal transportation system, emphasizing connectivity of pedestrian, transit, highway, and other modal elements.

MPOs in small and medium sized areas have an opportunity and a responsibility to consider these issues when developing metropolitan goals, plans, and programs, and in implementing these in cooperation with local land use decision-makers. The issues discussed in these documents address how pedestrian- and transit-oriented land use strategies could enhance livability and quality of life and address environmental quality concerns. They also address how these strategies could calm traffic in appropriate locations, mitigate the negative effects of sprawl, implement regional growth management goals, and preserve, revitalize, or create community “Main Streets.”

This section will discuss the three dimensions in which MPOs can address these issues:

- Site design;
- Neighborhood and corridor planning; and
- Regional smart growth strategies.

1. Site Design

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2. Neighborhood Development and Corridor Strategies

a. Transit-Oriented Development and Livable Communities

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b. Neotraditional Development

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c. Traffic Calming Measures

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- (8) B65
- (9) B70

3. Regional Smart Growth Strategies

a. Growth Management

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- (16) B70

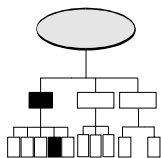
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- (20) C14

b. Environmental Quality

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- (3) B3
- (4) B14
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c. Transit Impacts

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- (23) C8



D. HIGHWAYS AND LAND USE

Highway expansions impact land use, urban form, and development in urban, suburban, and rural areas. In urban and suburban settings, salient issues include the impacts of capacity enhancements on land use and the related impacts of land development fronting highways with enhanced capacity on traffic volume growth. Other issues include the effects of freeway grade on land value, the impacts of highway capacity expansions on urban form, the effects of freeway construction on land uses, and the effects of high-occupancy vehicle facilities on land uses. Rural areas may be equally interested in the impacts of highways on nonmetropolitan economic growth and development, particularly potential land development at freeway interchanges and its effects on existing communities.

1. Urban

a. Impacts of Highway Expansions

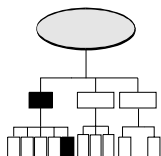
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- (9) C4

b. HOV Impacts

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- (2) B47

2. Rural

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- (5) C4

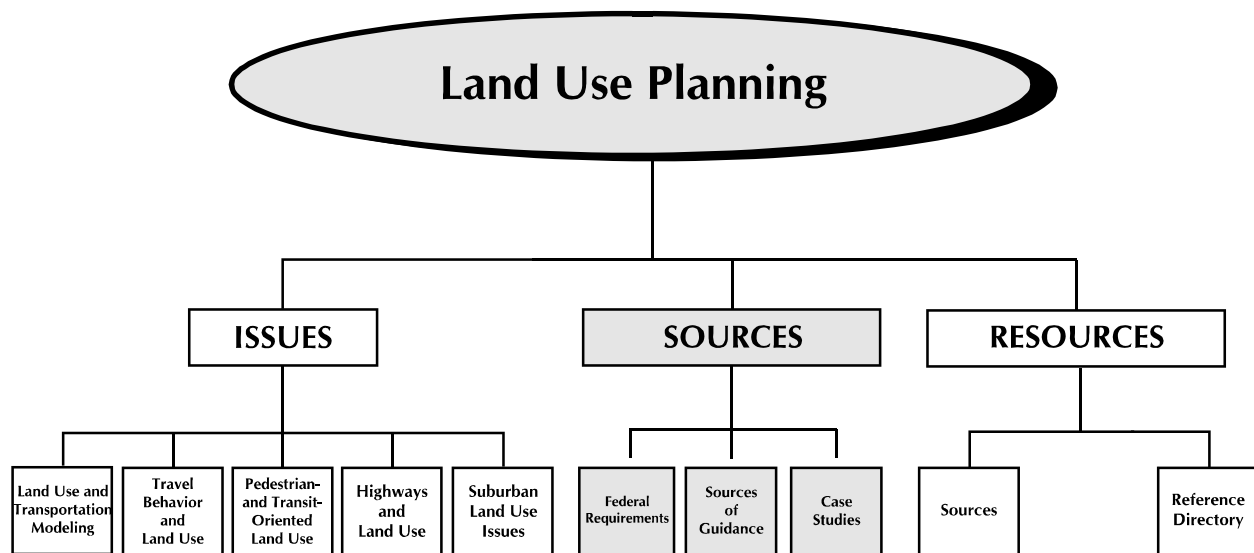


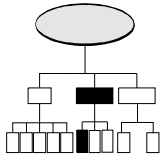
E. SUBURBAN LAND USE ISSUES

Frequently, in metropolitan areas of all sizes, the bulk of land development and transportation improvements occur within a suburban setting. Therefore, MPOs should be cognizant of the issues relating to land use and transportation in a suburban context. These issues include addressing suburban traffic congestion, understanding suburban travel behavior, transit- and pedestrian-sensitive suburban land uses and design, creating more efficient suburban activity centers, and the effects and costs of sprawl.

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Sources Outline





Sources Outline

A. FEDERAL REQUIREMENTS RELATING TO LAND USE PLANNING

1. Existing ISTEA Requirements

- a. *Metropolitan Planning: 23 U.S.C. 134(f)*
(U.S. Department of Transportation, 1998b)

“FACTORS TO BE CONSIDERED.--In developing transportation plans and programs pursuant to this section, each metropolitan planning organization shall, at a minimum, consider the following: . . . (4) The likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans.”

- b. *Metropolitan Planning: 49 U.S.C. 5303(h)*
(U.S. House of Representatives, 1998a)

“Balanced and Comprehensive Planning. - (1) To the extent practicable, the Secretary of Transportation shall ensure that amounts made available under section 5338(g)(1) of this title to carry out this section and sections 5304-5306 of this title are used to support balanced and comprehensive transportation planning that considers the relationships among land use and all transportation modes, without regard to the programmatic source of the planning amounts.”

- c. *Discretionary Grants and Loans: 49 U.S.C. 5309(e)*
(U.S. House of Representatives, 1998a)

“Criteria for Grants and Loans for Fixed Guideway Systems. -

“(3) In making a decision under paragraph (2) of this subsection, the Secretary of Transportation shall - C) identify and consider mass transportation supportive existing land use policies and future patterns;”

- d. *Metropolitan Transportation Planning Process Elements:*
23 CFR 450.316(a)
(U.S. Department of Transportation, 1998c)

“Section 134(f) of title 23, U.S.C., and Federal Transit Act section 8(f) (49

U.S.C. app. 1607(f)) list 15 factors that must be considered as part of the planning process for all metropolitan areas. The following factors shall be explicitly considered, analyzed as appropriate, and reflected in the planning process products:

“(4) The likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans (the analysis should include projections of metropolitan planning area economic, demographic, environmental protection, growth management, and land use activities consistent with metropolitan and local/central city development goals (community, economic, housing, etc.), and projections of potential transportation demands based on the interrelated level of activity in these areas);”

e. *Major Metropolitan Transportation Investments:*
23 CFR 450.318(c)
(U.S. Department of Transportation, 1998c)

“To the extent appropriate as determined under paragraph (b) of this section, major investment studies shall evaluate the effectiveness and cost-effectiveness of alternative investments or strategies in attaining local, State and national goals and objectives. The analysis shall consider the direct and indirect costs of reasonable alternatives and such factors as mobility improvements; social, economic, and environmental effects; safety; operating efficiencies; land use and economic development; financing; and energy consumption.”

f. *Metropolitan Transportation Plan: 23 CFR 450.322*
(U.S. Department of Transportation, 1998c)

“(a) The metropolitan transportation planning process shall include the development of a transportation plan addressing at least a twenty year planning horizon. The plan shall include both long-range and short-range strategies/actions that lead to the development of an integrated intermodal transportation system that facilitates the efficient movement of people and goods. The transportation plan shall be reviewed and updated at least triennially in nonattainment and maintenance areas and at least every five years in attainment areas to confirm its validity and its consistency with current and forecasted transportation and land use conditions and trends and to extend the forecast period. The transportation plan must be approved by the MPO.

“(b) In addition, the plan shall:

“(9) Reflect, to the extent that they exist, consideration of: the area's comprehensive long-range land use plan and metropolitan development objectives; national, State, and local housing goals and strategies, community development and employment plans and strategies, and environmental resource plans; local, State, and national goals and objectives such as linking low income households with employment opportunities; and the area's overall social, economic, environmental, and energy conservation goals and objectives;”

g. Early Coordination, Public Involvement, and Project Development: 23 CFR 771.111(g)
(U.S. Department of Transportation, 1998c)

“For major transportation actions, the tiering of EISs as discussed in the CEQ regulation (40 CFR 1502.20) may be appropriate. The first tier EIS would focus on broad issues such as general location, mode choice, and areawide air quality and land use implications of the major alternatives. The second tier would address site-specific details on project impacts, costs, and mitigation measures.”

2. New Requirements

a. Transportation Equity Act for the 21st Century, Section 1203: Metropolitan Planning (Conference Report on H.R. 2400)
(U.S. Department of Transportation, 1998a)

“(a) General Requirements.--Section 134(a) of title 23, United States Code, is amended to read as follows:

“(a) General Requirements.--

“(1) Findings.--It is in the national interest to encourage and promote the safe and efficient management, operation, and development of surface transportation systems that will serve the mobility needs of people and freight and foster economic growth and development within and through urbanized areas, while minimizing transportation-related fuel consumption and air pollution.

“(f) Scope of Planning Process.--

“(1) In general.--The metropolitan transportation planning process for a metropolitan area under this section shall provide for consideration of projects and strategies that will--

“(A) support the economic vitality of the metropolitan area,

especially by enabling global competitiveness, productivity, and efficiency;

‘(B) increase the safety and security of the transportation system for motorized and nonmotorized users;

‘(C) increase the accessibility and mobility options available to people and for freight;

‘(D) protect and enhance the environment, promote energy conservation, and improve quality of life;

‘(E) enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;

‘(F) promote efficient system management and operation; and

‘(G) emphasize the preservation of the existing transportation system.’”

- b. Updated Explanatory Materials for the Transportation Equity Act for the 21st Century
(U.S. House of Representatives, 1998b)*

(1) Introductory Note to Updated Explanatory

Materials

“The House Conferees from the Committee on Transportation and Infrastructure on the Transportation Equity Act for the 21st Century (TEA 21) are pleased to published the accompanying updated explanatory materials related to TEA 21. These materials reflect what we intended the legislative history of TEA 21 to be, had there been adequate time to develop a complete report.

“TEA 21 is comprehensive surface transportation legislation that reauthorized the Federal highway, transit, highway safety grant and surface transportation research programs for Fiscal Years 1998 through 2003. It also contains legislation extending the Highway Trust Fund and its taxes, changes to the Balanced Budget and Emergency Deficit Control Act of 1985 that ensure the trust fund revenues are spent, budgetary offsets to pay for the increased levels of funding authorized, provisions related to ozone and particulate matter standards, the National Highway Traffic Safety Administration Act of 1998, provisions related to rail programs, comprehensive ‘one-call’ notification programs, and the

Sportfishing and Boating Safety Act of 1998.

“The Conference Report on TEA 21 (House Report 105-550) passed the House of Representatives and the Senate on May 22, 1998, and was signed into law by the President on June 9, 1998, as Public Law 105-178.

“Several important provisions agreed to by the House and Senate Conferees were inadvertently omitted from the version of TEA 21 that passed the Congress and that was signed into law. It also contained several technical errors. To restore these omissions and correct the errors, Congress subsequently passed the TEA 21 Restoration Act as Title IX of the Internal Revenue Service Restructuring and Reform Act of 1998. The President signed it into law on July 22, 1998, as Public Law 105-206. The attached version of TEA 21 reflects the changes made by the TEA 21 Restoration Act.

“Due to the tight schedule for finalizing the TEA 21 Conference, the Statement of Managers accompanying TEA 21 contained technical errors and omissions relating to Title I (Federal-aid Highways) and Title V (Transportation Research). The attached version corrects these errors and contains more extensive descriptions of many TEA 21 provisions.

“We hope that upcoming Committee Print of TEA 21 and the accompanying explanatory materials will be a useful document for interpreting TEA 21 since it was extensively amended soon after being signed into law, and since the original Statement of Managers did not properly reflect the legislation that was signed into law.”

(2) Metropolitan Planning: Section 1203

“The Conference substitute adopts a combination of both the Senate and House provisions. The substitute retains the basic current metropolitan planning structure and processes. As included in both bills, the 16 planning factors are streamlined to seven general factors to be considered in the planning process. In considering the relationship between transportation and quality of life, metropolitan planning organizations are encouraged to consider the interaction between transportation decisions and local land use decisions appropriate to each area. The language clarifies that the failure to consider any specific factor in formulating plans, projects, programs, strategies, and certification of planning processes is not reviewable in court. The Conference substitute also adopts the House provision including economic growth and development as a general requirement in metropolitan planning.”

c. FTA New Starts Criteria Under 49 U.S.C. Section 5309

(Federal Transit Administration, 1996)

(1) Policy Discussion Paper

“In order to generate comment from the public on the best approach FTA could take to implement the changes required by ISTEA in the context of the Executive Order, on September 28, 1994, FTA issued a Policy Paper entitled ‘Revised Measures for Assessing Major Investments: A Discussion Draft.’ The paper was circulated to a broad audience, including State and local governments, transit agencies, Metropolitan Planning Organizations (MPOs), consultants, and other interested parties. Comments were requested on the paper and all aspects of the issue, due November 1, 1994, although FTA continued to accept comments received through December 15, 1994. The following summarizes the discussion paper.

“Based on a detailed review of a wide range of candidate measures, the paper suggested use of the following measures as a means of assessing how well candidate New Starts projects are ‘justified’:

1. “For ‘cost-effectiveness’ - the total incremental cost per incremental transit passenger-trip (or possibly, per incremental passenger-mile in certain cases), where the projected streams of capital and net operating costs and passenger-trips have been (in the case of the costs) expressed in constant dollar terms, and (in all cases) both cost and ridership have been discounted at the social discount rate, compared to the Transportation System Management (TSM) alternative.”
2. “For ‘mobility improvements’ - 1) the projected aggregate value of travel time savings per year (forecast year) anticipated from the new investment compared to the TSM alternative. This aggregate includes the travel time impacts on people using competitive modes, along with those on the trips made by transit (both new and former transit riders). It is a net figure in the sense that travel time increases should be explicitly considered and used to offset the time savings of those people who experience savings. It would be expressed in absolute and regional percentage change terms. It would be valued using a set percentage of the average wage rate in the urbanized area. 2) the absolute number of zero-car households (or alternatively, the people resident in those households) located within TSM alternative.”
3. “For ‘operating efficiencies’ - 1) the forecast change in operating cost per vehicle service-hour (or service-mile), for that part of the system

that will be directly affected by the proposed new investment, expressed in absolute and regional percentage change terms, compared to the TSM alternative. 2) the forecast change in passengers per vehicle service-hour (or service-mile), calculated on the same basis, also expressed in absolute and regional percentage change terms, compared to the TSM alternative. 3) the forecast change in passenger miles per vehicle service-hour (or service-mile), calculated on the same basis, also expressed in absolute and regional percentage change terms, compared to the TSM alternative.”

4. “For ‘environmental benefits’ - 1) the value of the forecast change in criteria pollutant emissions and in greenhouse gas emissions, ascribable to the proposed new investment, discounted and levelized, expressed in absolute and regional percentage change terms, compared to the TSM alternative. The value of the emissions would be calculated based on standardized assumptions about the unit value of each emission. 2) the forecast change in the consumption of fuels of different types, ascribable to the proposed new investment, discounted and levelized, expressed in absolute and regional percentage change terms, compared to the TSM alternative.”
5. “For ‘transit supportive existing land use policies and future patterns’ - the degree to which local land use policies are likely to foster transit supportive land use, measured in terms of the kinds of policies in place, and the commitment to these policies.”

(2) Criteria: Transit-Supportive Land Use

“Comments: Most of the comments on the criteria for evaluating transit-supportive land use policies concerned the difficulties involved in determining what to measure. Problems cited included the difficulty of obtaining regional land-use commitments before a project has been approved, the subjectivity of this measure, and the difficulty in making comparisons from region to region.

“The transit industry group suggested the use of a descriptive rating of projects according to factors such as existing land use, containment of sprawl, transit-supportive corridor policies, supportive zoning regulations near transit stations, tools to implement land use policies, and performance of those policies. Alternatively, a ‘multiple criteria ordinal ranking’ approach could be used, where the project would be given a rating of ‘high,’ ‘medium,’ or ‘low’ according to the same factors.

“Response: The final policy statement implements a combined rating for important land use factors consisting of both ‘high,’ ‘medium,’ and ‘low’ ratings and corresponding descriptive indicators. Projects will be rated according to existing land use, containment of sprawl, transit-supportive corridor policies, supportive zoning regulations near transit stations, tools to implement land use policies, and the performance of land use policies. The one-word rating acts as a summary for the evaluation of each respective factor, while the description acts as the definition of that rating. Ratings for transit supportive land use will be developed in the same manner as that currently used by FTA to assess financial capacity, and expressed in a single rating based on the ratings for each factor.

“In addition to these five criteria, the transit industry group suggested a sixth that would measure the historical and projected level of commitment a region must exhibit in order to have a successful high-capacity transit project (i.e., a new start). This criterion would address a number of factors which would otherwise be overlooked by the other measures. These would include 1) local efforts to adopt and enforce transit-supportive parking policies, 2) efforts to coordinate highway and transit project development (for example, withdrawing a highway improvement project in favor of the proposed transit investment), and 3) an ‘implementation capability’ measure to judge the likelihood that forecast costs will be accurate. This last factor would focus on the ability of a region to successfully implement a major transit investment, based on its record of experience with such projects. Descriptive ratings were recommended for each of these factors; alternatively, a ‘multiple criteria ordinal ranking’ approach could be used, where the project would be given a rating of ‘high,’ ‘medium,’ or ‘low’ according to the same factors.

“FTA recognizes that there are often additional factors which may contribute to the overall success of the project. Thus, in response to this recommendation, FTA has adopted a sixth project justification criterion for ‘other relevant factors.’ This criterion will evaluate the degree to which the institutions (local transportation planning, programming and parking policies, etc.) assumed in the forecasts are in place, the capability of project sponsors to manage a project of the planned scope, and such other factors as may be relevant to the successful implementation of the project and/or local and national priorities. This provides an added assessment of the likelihood of a successful transit investment, measured against regional considerations. The measure combines both the ‘high,’ ‘medium,’ and ‘low’ ratings with the descriptive ratings, as appropriate, in order to provide both a ‘summary’ rating for each factor and its definition.

“This comment also recommended that factors for successful implementation of transit-supportive land use plans be included in this

measure. However, this would largely duplicate the information collected under the evaluation criteria for 'Transit Supportive Land Use Policies.' While it may be possible to combine these two criteria, the use of a separate measure for land use is more consistent with statute."

**(3) Project Justification Criteria for Grants and Loans
for
Fixed Guideway Systems**

"In order to approve a grant or loan under Section 5309 (formerly Section 3), the Secretary of Transportation must find that the proposed project is justified as described in Section 5309 (e)(2)(B) (formerly Section 3(i)(1)(B)), and supported by an acceptable degree of local financial commitment, as described in Section 5309 (e)(2)(C) (formerly Section 3(i)(1)(C)).

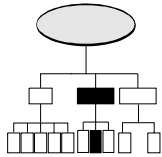
"To make the statutory approval required for a project to enter preliminary engineering, as required by Section 5309(e)(2)-(7) (formerly Section 3(i)), FTA will evaluate information developed in Major Investment Studies. The method used to make this determination will be a Multiple Measure approach in which the merits of candidate projects will be evaluated against a set of measures. These measures will also be used to determine which projects to recommend for funding in the report required by Section 5309(m)(3) (formerly Section 3(j)). The ratings for each measure will be updated throughout the preliminary engineering and final design processes, as costs, benefits and impacts are more precisely defined. As a candidate project proceeds through the stages of the development process, a greater degree of certainty is expected with respect to these measures. The measures are as follows:

1. "For 'mobility improvements' - 1) The projected value of aggregate travel time savings per year (forecast year) anticipated from the new investment, compared to both the no-build and TSM alternatives. This aggregate includes the travel time savings of people using competitive modes, along with those on the trips made by transit (both new and existing transit riders). It is a net figure in the sense that travel time increases should be explicitly considered and used to offset the time savings of those people who experience savings. Travel time savings for those switching from highways to transit will be calculated using a consumer surplus approach, taking one-half of the total travel time savings for existing riders. The net figure will be expressed in terms of the dollar value of the projected travel time savings for the study area. Total travel time savings will be valued at 80 percent of the average wage rate in the urbanized area. 2) The absolute number of low income households (households below the

poverty level) located within 1/2 mile of boarding points associated with the proposed system increment.”

2. “For ‘environmental benefits’ - 1) the value per year (forecast year) of the forecast change in criteria pollutant emissions and in greenhouse gas emissions, ascribable to the proposed new investment, calculated according to standardized national assumptions about the unit value of each emission; 2) the forecast net change per year (forecast year) in the regional consumption of energy, ascribable to the proposed new investment, expressed in British Thermal Units (BTU); and 3) current Environmental Protection Agency designations for the region's compliance with National Ambient Air Quality Standards. The new start alternative will be compared to both the no-build and TSM alternatives.”
3. “For ‘operating efficiencies’ - the forecast change in operating cost per passenger-mile (forecast year), for that part of the system that will be directly affected by the proposed new investment, expressed in terms of absolute dollar value. The new start will be compared to both the TSM and no-build alternatives.”
4. For ‘cost-effectiveness’ - the incremental change in total capital and operating cost per incremental passenger, based on the forecast change in annual transit ridership (forecast year) and the annualized total (Federal and local) capital investment and operating cost, compared to the no-build and TSM alternatives.
5. “For ‘transit supportive existing land use policies and future patterns’ - the degree to which local land use policies are likely to foster transit supportive land use, measured in terms of the kinds of policies in place, and the commitment to these policies. A combined rating consisting of both ‘high,’ ‘medium,’ and ‘low’ ratings and corresponding descriptive indicators will be used to assess each of the following six factors: 1) existing land use; 2) containment of sprawl; 3) transit-supportive corridor policies; 4) supportive zoning regulations near transit stations; 5) tools to implement land use policies; and 6) the performance of land use policies. The ratings for each factor will then be combined into a single ordinal rating for transit supportive land use.”
6. For ‘other factors’ - 1) the degree to which the institutions (local transportation planning, programming and parking policies, etc.) are in place as assumed in the forecasts, 2) project management capability, and 3) additional factors relevant to local and national priorities and relevant to the success of the project. Ratings will be

expressed as appropriate in ordinal ratings and descriptive statements.”



B. SOURCES OF GUIDANCE

1. ULI on the Future: Smart Growth (Urban Land Institute, 1998)

Smart growth is “... not about no growth, or even slow growth. Most people want the jobs, tax revenues, and amenities that growth and development can provide. But they want them without degrading the environment, raising local taxes, increasing traffic congestion, or breaking local government budgets — and they believe that development is very much a part of the solution. As a result, consensus is emerging at the community level in support of smart growth. Smart growth invests time, attention, and resources in restoring community and vitality to center cities and older suburbs and in encouraging more town-centered and transit- and pedestrian-oriented new development. . . .

“In a growing number of communities across the country, people are finding ways to craft state laws, wield local zoning ordinances, ply environmental regulations, tame traffic, engender public support, cooperate across local political boundaries, and work together to encourage exemplary development in the places where development makes sense. If current trends are any indicator, this will open up new opportunities, creating a future path that will differ significantly from that of the past.”

A diverse group has coalesced with smart growth, in terms of geography, political affiliation, and discipline. Developers, business people, environmentalists, academicians, community activists, government officials at all levels, and transportation professionals; the Urban Land Institute, the American Planning Association, and the Institute of Transportation Engineers; New Jersey Governor Christine Whitman (R) and Maryland Governor Parris Glendening (D); and cities and metropolitan areas from California to Texas to Oregon to Florida are all involved with Smart Growth. This report discusses the trends and circumstances that have created the need to address new concerns and the strategies that have been used, and that might be used, to address such concerns as open space, water quality, air quality, traffic congestion, fiscal constraint, changing demographics and consumer preferences, suburban decay, and conflict over growth issues. The sections of this document address transportation, housing, the States, regional cooperation, and center cities.

2. Smart Growth and Neighborhood Conservation

(Maryland Office of Planning, 1998)

This document discusses Maryland's Smart Growth Initiative. The Initiative's programs include: priority funding areas, rural legacy program, volunteer cleanup and brownfields programs, job creation tax credit program, and the live near your work program. The document also presents other programs which support the Initiative in the areas of neighborhoods, job creation, public schools, public safety, transportation, open space preservation, and the environment.

3. Why Smart Growth: A Primer

(International City/County Management Association, 1998)

"Smart growth shifts the terms of debate away from the pro- and anti-growth context of the past. Coalitions of developers, environmentalists, citizens, and government officials are banding together to address the new fundamental question, which is not whether to grow but how. Successful communities have a vision of where they want to go and of what things they value in their neighborhoods and downtowns. Their plans for development reflect these values and answer questions facing communities nationwide. How can a community capture the benefits of growth without overcrowding its schools? How can a community maintain its small-town charm and character while accommodating new residents and prospering economically? How can a community, city, or suburb benefit from growth but not suffer the post-growth disinvestment that so often follows?

"Across the country in large metropolitan areas and rural towns alike, growth and development are receiving increased attention. Growth patterns are linked to a community's success in providing quality schools, relieving traffic congestion and air pollution, controlling taxes, and providing economic opportunity. Major regional newspapers in Kansas City, Missouri, and Charlotte, North Carolina, reported on this connection, examining 'sprawl' in terms of loss of farmland and fiscal stability, as well as of disinvestment in older cities and suburbs. Rural areas are responding to the growth they see heading their way. In rapidly growing communities from Virginia to Idaho, small towns hold local forums on growth. Anticipating rapid development, they seek to preserve their way of life."

Part I presents case studies demonstrating the importance of asking "smart" questions about proposed growth. Part II discusses the outcomes of growth: local government costs and revenues, economic impacts, growth as an economic development strategy, environmental impacts,

and community impacts. The first appendix provides a set of questions which help identify the kinds of development impacts communities may need to address in the areas of fiscal impacts, economic impacts, environmental impacts, social impacts, and other long-term considerations. The second appendix previews some tools for communities and local governments, such as alternative growth patterns (infill or neotraditional communities), transferrable development rights, urban growth boundaries, and others.

4. Moving Beyond Gridlock: Traffic and Development (Dunphy, 1997: Excerpt from Preface)

“What is the transportation problem? In most urban areas, it is enormously complex and not well understood by the experts, let alone by the public. Failure of public agencies to resolve critical transportation concerns can cause the problem to spill over into spheres ill-equipped to handle it, including the private sector. In many regions of the country that are not in compliance with federal air quality standards, controversial employee trip reduction programs have been advocated with the major burden for implementation assigned to private sector employers. . . .

“This is not a how-to book. Recognizing the enormous challenge of delivering transportation services that meet private needs with largely public funds, it attempts to put the transportation problem in the context of regional land use and development decisions, and to offer some guidance to those responsible for making transportation improvements and to community planners and developers who approve and implement the projects that need transportation services.

“There are probably no examples of large urban regions that have truly solved the transportation problem, whatever that means. However, the case study research in this book identifies some of the policies that make things worse, explores some of the practices that hold promise for improving the relationship between transportation and land use, and examines the experiences of some of U.S. and Canadian urban areas that have accepted the challenge of delivering transportation.”

“The first section looks at what is the urban transportation problem from a number of angles — including its nature, its causes, and the responsibility for its solution. Chapter 1 describes the problem quantitatively. It reviews data on the causes of traffic growth; statistical comparisons of U.S. urban areas over 1 million people; and variations in supply, demand, and density measures for major modes of travel. Chapter 2 takes a look at how real estate projects and major transportation projects are developed, comparing the players, the process, the time lines, and the politics.

Chapter 3 looks at major demographic trends and what they imply for travel into the next century.

“The second section examines the practical experiences of a number of large metropolitan regions that have scored some remarkable successes in dealing with traffic and growth. The seven case studies are of regions that have taken a series of significant steps to relate transportation and land use policies more effectively. They include three areas — Portland, San Diego, and Toronto — that have emphasized regional development policies and transit. Phoenix is included for its urban villages growth management initiative in the early 1980s and its bold freeway development program in the second half of the decade. Two of the regions — have concentrated on increasing transportation investments and meeting private sector needs, with a lesser focus on regional growth policy. These six regions have all experienced high rates of growth in recent years. The seventh region — St. Louis — has not. However, despite its stagnant regional economy, St. Louis has growth centers, transportation investment needs, and a new and highly praised rail transit system, by which it hopes to catalyze in a reenergized core.

“A wrap-up chapter summarizes some of the ideas from these (and other) experiences. ULI’s hope is that this book will assist developers and transportation providers in dealing with future transportation needs.”

5. Transit-Supportive Development in the United States (Cervero, 1993)

“Many American suburbs and exurbs are hostile environs to transit users and pedestrians. Campus-style office parks, walled-in residential subdivisions, and mega-malls are often designed so that it is difficult to access them or get around by any means other than the private automobile. . . .

“This report examines recent experiences in the U.S. with transit-supportive developments — projects which, by design, give attention to the particular needs of transit users and pedestrians. The study focuses mainly on experiences in the suburbs and exurbs of large U.S. metropolises, which in most cases are served only by bus transit. Assessments are carried out at three levels — individual sites, neighborhoods, and communities. Since in the course of the research we found fewer U.S. examples of transit-supportive developments in bus-only suburban-exurban environs than popular accounts might have us believe, the study gives particular emphasis to implementation issues — how recent market and regulatory factors have influenced the transit-supportive design movement.”

The first chapter provides a brief history of, the current policy environment for, and possible benefits from transit-oriented development. The second chapter provides a review of previous research for macro-level analyses, the intermediate-scale of corridors and activity centers, and the micro-scale of neighborhoods, station areas, and sites.

“Chapter Three focuses on the site level. Its purpose is twofold: one, to identify suburban, bus-served sites that are considered locally to be good examples of transit-supportive development; and two, to summarize the contents of guidelines which have been prepared to date to promote transit-sensitive designs and land-use plans and to showcase some good examples of these guidelines.”

Chapter Four presents case studies of transit-supportive development at the site and activity center levels from Chicago, San Diego, San Francisco Bay Area, Seattle Area, and Washington, DC, area. The results of land use and transit relationships at the neighborhood level are presented in the fifth chapter, and the macro-scale analysis is given in the sixth chapter. This includes a discussion of commuting behavior in traditional communities, edge cities, planned versus conventional suburban communities, planned communities in Great Britain, new towns in France, and the experience of Stockholm, Sweden.

The final chapter includes a summary and conclusions. The author concludes that while transit-friendly design features at the site level can enhance pedestrian accessibility, there is little evidence of measurable impact on transit demand from site level enhancements alone. However, combining transit-supportive design with travel demand management strategies can be mutually beneficial. “Overall, transit-supportive designs are helpful and well-intentioned, though fairly meaningless without good quality transit and rideshare services and proactive measures that reduce auto-dependency. ... In many areas, the transit-supportive design movement has so far had a bigger impact on the public than the private sector. This has mainly been in the form of convincing local planners of the importance of considering the needs of transit vehicles and pedestrians in the review of development proposals. ... At the neighborhood level, this research demonstrated that denser communities with more traditional gridiron street patterns generally average higher levels of transit and pedestrian commuting than nearby more auto-oriented neighborhoods, controlling for income and (less successfully) transit service levels. ... In combination, European experiences show that good land-use and transit planning as well as careful attention to site design complement each other extremely well and indeed must co-exist if substantial headway is to be made in luring commuters out of cars and into alternative modes of travel.”

6. Guidelines for Transit-Sensitive Suburban Land Use Design

(Beimborn and Rabinowitz, 1991: Excerpt from Abstract)

“This report provides guidelines for the planning and design of land use patterns that are sensitive to the needs of public transit. These guidelines are meant to create an efficient environment for future growth in suburban areas. The guidelines have been prepared from a market-based point of view. Design elements are proposed that directly address the success of development activities and transit services. The report discusses requirements for successful transit and provides design guidelines for land use, access systems and transit services through a range of scales.

“Transit-sensitive land use design can be developed through the designation of Transit Corridor Districts (TCDs) which would separate transit- and auto-oriented land uses. Such areas would have a mix of land uses with higher densities located near a transit route. A high quality access system for pedestrians and bicyclists should be provided to permit easy connections between buildings and transit vehicles. Guidelines are considerations and specific designs of individual districts where transit service is provided. Steps to implement the guidelines are also included.

“A prototype Transit Corridor District, based on the guidelines, is presented in the final section of the report. The proposed TCD illustrates how the guidelines can be applied at a specific location.”

7. A Guide to Land Use and Public Transportation, Volume I

(Snohomish County Transportation Authority, 1989)

“Making alternatives to the single-occupant auto a reality means creating new travel patterns based on land uses, road networks, pedestrian facilities and even employment practices that are public transportation compatible. This guide offers suggestions that local jurisdictions, developers, community groups, and land owners working with their local transit operators can use to locate and design activities and facilities and change trip-making behaviors so that options to autos can become realistic. . . .

“We are realizing that we must integrate the planning and development of our land and our transportation network. Planning for public transportation does not imply a radical departure from current development practices. The issue is not to change the land uses that make up a community, but rather to influence their mixture and design. Locating apartment houses on major streets with bus routes and installing sidewalks to bus stops are examples of planning for public transportation.

. . .

“A community can influence the public transportation compatibility of a plan by considering public transportation as it addressed each of these development issues:

- Pedestrian access
- The amount, cost, and location of parking
- The location of townhouses and apartments
- The location and design of shopping and employment
- The location of transit facilities
- The location of community facilities, schools, parks, etc.
- The mix of land uses
- The design of building complexes and their surroundings
- The design of residential developments
- The design of streets and intersections

“These issues are the topics of this guide to land use and public transportation.” The first chapter is an introduction to public transportation compatibility. The following chapters address how public transportation works, transit compatible land uses, model goals and policies for community plans, public transportation compatible zoning, transportation management, and transit compatible subdivision and site designs. The final chapter contains a worksheet for evaluating development projects using transit-compatibility indicators.

8. A Guide to Land Use and Public Transportation, Volume II (Snohomish County Transportation Authority, 1993)

This document offers eight strategies to make communities more transit compatible. The first is developing an urban center. “The chapter explains methods and tools that a city or town can use to envision, plan, organize, and build the centerpiece of its community. It draws from the experiences of other regions that have realized that good urban centers — vibrant, compact, and people-friendly — are key to livable regions and sustainable economies. From Toronto to Miami to San Francisco, regions are experimenting with new urban forms and with new approaches to urban center development. These experiences, as well as other, more time-tested urban planning methods, form the basis for the process described in this chapter.”

The second chapter “examines transit-friendly land use using this fundamental tool of the developer and the planner: the site plan. ... [It] shows site plans for ten *typical* development projects, ranging from shopping centers to business parks to subdivisions, and then offers a more transit-compatible alternative for each plan. In each case, the type and intensity of development remains essentially the same. The amount

of parking, the floor-space of the buildings, and the amount of land the project covers are generally kept constant, except where noted. The difference between the *typical* and the *transit compatible* site plans has mainly to do with how buildings are oriented with respect to streets and transit facilities and how sidewalks and other pedestrian features are designed. The key problems are labeled on the *typical* site plans, their solutions on the *transit compatible* site plans. These problems and solutions are generic, highlighting the main issues surrounding each type of project. In the real world, each development project will pose its own unique problems and opportunities.”

The third chapter deals with transit-friendly shopping centers. “There are many different ways to make neighborhood shopping centers with stand-alone buildings pedestrian accessible and transit-friendly. This section illustrated various design treatments for four neighborhood shopping centers with different site-plans.” Chapter four illustrates “how a typical strip commercial area can be changes into a pedestrian and transit-friendly shopping area. The changes are shown in three five-year phases.”

The next chapter introduces the concept of mixed use. “An easy walk from the office to a nearby deli. A Saturday morning stroll to the neighborhood park with a stopover at the corner bakery. A single after-work stop to pick up the kids, drop off the cleaning, and shop for a few grocery items. Simple conveniences like these are possible where housing, shopping, work places, and recreation are ‘mixed,’ or arranged so that people can walk between them. *Mixed use*, as urban planners call such arrangements, would seem to be a common sense approach to community planning, and in fact it was the norm in communities designed in the ‘pre-auto’ era. But over the past 50 years, the arrangement and design of land uses has been increasingly scaled to driving: housing, work, shopping, and recreation are now scattered miles apart, and even when located near one another, these basic daily activities are carefully ‘buffered’ from one another with walls and landscaping that make it difficult to walk between them.”

Chapter six discusses barrier-free pedestrian access. “With the passage of the landmark Americans with Disabilities Act (ADA) of 1990, government and business are taking greater interest and a more systematic approach to barrier-free design. ADA is a sweeping federal law intended to give people with disabilities better access to employment, services, and transportation. ADA is aimed at eliminating barriers for people with disabilities, but the benefits of barrier-free design go further: places that are accessible for people with disabilities are accessible for everyone. In a community where pedestrian travel is safe, easy and

convenient and transit is easily accessible, everyone gains choices about how and where they go.”

Chapter seven presents transit-friendly planning for small communities. “In certain ways, the smaller, older communities of Snohomish County are models of transit-friendly land use and pedestrian-oriented design. Many of these towns grew up along train or trolley lines at a time when few people owned cars and when commuting twenty miles was the rare exception rather than the rule. Small blocks, wide sidewalks, neighborhood stores, and alleys were natural, common sense design back when most trips included some travel by foot. Today these places are the small town ‘Main Street’ and the ‘Old Town Centers’ which, because of their liveliness and pedestrian-friendly design, are sought out by county residents when they want to shop, walk and get a taste of the days when people were as much a part of the street scene as cars.”

The final chapter briefly reviews “state and regional initiatives and examines them in the context of a common tenet — the need to more effectively match land development with adequate transportation systems. Then the chapter provides model goals and policies aimed at helping counties, cities, and transit companies synchronize their planning efforts to forge strong links between land use and transportation.”

9. The Effects of Land Use and Travel Demand Management Strategies on Commuting Behavior

(Cambridge Systematics, et al., 1994b: Excerpts from Introduction)

“There is considerable current interest in the effects of urban design and land use characteristics on the transportation choices made by commuters. The underlying assumption is that these employment site characteristics have an important influence on a person’s willingness to commute by transit, ridesharing, bicycling, or walking — modes other than driving alone. Further, the selection of transportation demand management (TDM) strategies that an employer may choose to implement should be a function of surrounding site characteristics, and that the combination of site characteristics and TDM strategies can have a positive interactive effect in influencing an employee’s choice of commute travel mode. While the effectiveness of travel demand management strategies, implemented both individually and in combination, has been investigated, relatively little empirical work has been done to evaluate the interactive effects of land use and TDM strategies on commuting behavior.

“For this project, an integrated database of land use characteristics and

travel demand management strategies was developed for a sample of specific employment locations in the Los Angeles urban area. The integrated database was constructed by adding land use and site information, developed through field observation, to the 'Regulation XV' dataset of the South Coast Air Quality Management District (SCAQMD). The SCAQMD dataset includes information about aggregate employee travel characteristics, and the incentive programs offered by employers. This integrated database was then analyzed to explore the interactions that may exist between travel demand management programs, land use, urban design characteristics, and employee mode of travel. The primary objective was to develop conclusions about the combined impacts of land use and travel demand management strategies on employee travel behavior.

"Information was collected regarding the land use and urban design characteristics of a work site, the set of transportation incentives provided to the employees by the employer at that site, and the mode of travel by employees both before and after implementation of the transportation incentives for the trip between home and work. Data were collected and analyzed for individual employment sites. Data were not available regarding the characteristics or travel behavior of individual employees at a given work site, only the aggregate distribution of modal shares. Information was not available in the dataset about the residential end of the work trip. Similarly, data on midday travel, trip changing, or other related topics were not available.

"The second section of this report describes the methodological approach utilized, including the specific data collection and analysis procedures. Findings of the statistical analyses are presented in the third section. The effects of various travel demand management strategies were examined both individually and in combination with land use characteristics. General conclusions are presented in the final section. The overall finding is that an interaction effect does indeed exist. The effectiveness of programs of travel demand management measures is increased at those locations where supportive land use and urban design characteristics also exist.

"The results presented here represent an initial or preliminary analysis of an extensive dataset; considerable additional analysis is possible and is encouraged. The integrated employment site, land use/transportation database represents a valuable product by itself. Previously existing datasets do not include descriptions of both land use and travel demand management programs for individual employment sites."

The following conclusions were drawn in this report:

- Financial incentives are important as part of a TDM strategy
- Specific land use and urban design characteristics influence mode choice
- A positive interactive effect exists between land use characteristics and financial incentives
- Tradeoffs exist between ridesharing, transit, and walk/bike
- Employer-provided transportation assistance programs are most helpful at sites having a variety of convenience-oriented services
- Selected individual sites attain high levels of non-drive alone commuting
- The results are transferrable to other urban areas

10. Short-Term Travel Model Improvements (Cambridge Systematics, et al., 1994a)

“This report summarizes several potential improvements to the traditional urban travel demand modeling process. These improvements generally could be implemented in the short term in most urban areas, and many have been tested or are in use.” Chapter Three of the report deals with land use allocation models.

“Land use allocation models improve the traditional transportation planning modeling process by adding the ability to reflect the effects of transportation accessibility and other measures on the locations of future development. The traditional four-step travel modeling process is sequential and ignores the effects of transportation access (which can be measured in the outputs of trip assignment) on land use, and, therefore, trip generation. Transportation professionals are becoming increasingly aware of the need to incorporate such relationships into travel demand models, and legislation such as the 1990 Clean Air Act Amendments requires that such factors be considered.”

“ITLUP (DRAM / EMPAL), from S.H. Putman Associates, is the only land use allocation model widely used in the U.S. It is based on the Lowry formulation and has been used successfully in many cities. Some improvements to the Lowry/Putman formulation have been made in other areas, using ITLUP or specially developed software. ITLUP allows the consideration of transportation accessibility in determining future land use development, but does not explicitly consider economic factors, such as land prices, in location decisions. The instillation of ITLUP or a similar model would require, in most areas, the participation on S.H. Putman Associates or another consultant familiar with such models.

“MEPLAN is a commercially available model that has been used in many cities abroad. It has the advantage over ITLUP of explicit consideration of economic factors other than transportation accessibility and land availability in location choice. However, it requires a great deal of data and a long time to calibrate. The use of MEPLAN would likely require the participation of the developer or another foreign consultant to install.”

11. TMIP Land Use Modeling Conference Proceedings

(Shunk, et al., 1995: Excepts from Summary)

This document summarizes presentations by Elizabeth Deakin (Keynote Address), Michael Wegener (Current and Future Land Use Models), Michael Batty, et al. (Draft Data Requirements for Land Use Modeling), and Robert Dunphy (Understanding the Decision Makers). It also presents a summary of six workshop groups' observations and recommendations.

“For the short term, there was broad consensus reached by workshop participants that there is a need for a comparative description of the theory, variables and parameters of currently available models that would allow agencies to make informed choices for model applications. A need for guidelines and advice on the process which the models are used was also noted by the groups. Pilot programs were recommended that would implement a range of land use forecasting techniques from which experience and guidance could be developed.

“Extensive research needs were identified that would address improving the precision, accuracy and usefulness of model output. Participants indicated that the models should address a wider range of policies and their impacts, account for environmental constraints, and consider the actions of individuals, governments, developers, businesses and investors. There was also agreement among the groups that there should not be an attempt to develop a single model to accomplish all tasks. Rather, any new model system should be modular, with each piece having

a specific purpose, to allow for intervention to adjust data and information and to accommodate varying levels of spatial resolution and temporal dynamics. It was also uniformly agreed by the workshop groups that modeling efforts should take full advantage of geographic information systems (GIS) capable of bi-directional interaction with transportation and environmental models.

“The need for research on data collection/ acquisition strategies, employment data, and the generation and use of synthetic data were recognized by all of the workshops. Additional research on individual and business location choice decision processes and the use of stated preference and revealed preference surveys was also identified by the participants as necessary to model refinement and development.”

12. TMIP Conference Proceedings (Shunk and Bass, 1994)

This document summarizes conference proceedings in the areas of travel model improvements, air quality, software, data, land use, sample populations, training, and program guidance. The document identifies needs for additional research about land use in the following areas:

- Land use and development forecasting procedures to improve the information available for urban planning and to provide better information required to improve travel forecasts (including the effects of development patterns on activity patterns generated in travel models);
- Understanding the social and economic factors that influence development and travel;
- Methods of demographic and economic forecasting, including econometric procedures;
- Land use forecasting models and related procedures (especially those which improve predictions of land use activity locations while considering the marketplace and developer plans);
- Evaluation of urban development and land use patterns in the long-term; and
- Simple land use models for application in smaller or less complex urban settings.

13. Urban Design, Telecommuting and Travel Forecasting

**Conference
Proceedings and Papers**
(Day, 1997)

This conference was intended to “improve understanding of the influence on travel behavior of urban development patterns specifically designed to reduce motor vehicle travel and to assess the potential for telecommunications, particularly telecommuting, to reduce motor vehicle travel.”

This document presents a number of thoughtful papers which are quite relevant to land use planning. Among these are papers by:

- Robert Cervero — “Urban Design Issues Related to Transportation Modes, Designs and Services for Neo-traditional Developments,”
- Susan Handy — “Travel Behavior Issues Related to Neo-traditional Developments — A Review of the Research,”
- Ilan Salomon — “Telecommunications and the ‘Death of Distance’: Some Implications for Transport and Urban Areas,”
- Jim DeFrancia — “Implementing Non-Traditional Suburban Developments,”
- Michael Replogle — “Integrating Pedestrian and Bicycle Factors into Regional Transportation Planning Models,”
- G. Scott Rutherford, et al. — “Travel Impacts of Urban Form,” and
- Ronald Eash — “Incorporating Urban Design Variables in Metropolitan Planning Organizations’ Travel Demand Models.”

“Deliberations at the conference were organized in three subject tracks each of which addressed several specific questions related to its subject.” The first workshop, Principles of Urban Design, “enumerated the basic components of urban design and identified which among those components are likely to affect travel behavior. Features that distinguish the ‘New Urbanism’ from conventional development were described. . . . The workshop then discussed what transportation facilities are appropriate for New Urbanism communities and how those facilities should be designed to serve and blend with these designs. The discussion included consideration of how carefully integrated urban design and transportation facilities affect travel behavior, e.g., destination, mode and route choice.

“Finally the workshop enumerated key questions about the design/transportation relationship that need to be answered through further research and development. Principal among these is: What are the mechanisms that cause different urban designs to affect travel in various ways? A major concern is how to increase the consideration of the urban design/transportation concepts and effects in urban and transportation planning in MPOs and state DOTs.”

The second workshop, Effects of Urban Design on Travel Behavior, “began with consideration of current policy issues and a review of previous attempts to understand the influence of urban design on travel. The growing awareness of the need to consider and address these effects was indicated. A framework for assessing the current practice in regard to assessing these effects was developed.”

“Next the workshop discusses how elements of the travel environment influence travel choices and how urban design features affect the mechanism by which those effects occur. How policy and urban design features enter into that influence was also considered. Explanatory variables that reflect those elements and characteristics were then identified. How those elements and characteristics could be defined and measured and incorporated in travel models were considered. Consideration of the ambiguousness and colinearity in such models was addressed as well.”

“The workshop then turned its consideration to the factors that influence travel. The data needed to support the influential variables were identified along with the potential sources or surrogates for that data. Consideration of how to develop the desired variables from available or potential data was then undertaken. The range of values and travel choice sensitive for desired variables and how those can be forecast was considered. The potential policy implications of using the desired variables were also addressed.

“Then the discussions moved to considerations for developing travel models using this new kind of information. The state of practice for incorporating urban design influences in travel models was reviewed, and several potential model frameworks were discussed.”

The third workshop, effects of telecommuting on travel behavior, “began with discussion of how and the degree to which telecommunications influence travel behavior. It was concluded that telecommunication would have different kinds, degrees and mechanisms of effects on travel for different purposes, e.g., business versus shopping travel. Other considerations were the effects on mobile workers, e.g., traveling

salespersons, the impact of distance learning, delivery of medical services and government services.”

“The workshop then addressed the impacts of telecommunications on homes, neighborhoods and offices. These considerations included how telecommunications affect the location and design of homes and offices and the delivery of community services. The workshop also discussed the effectiveness of community telecommunication centers for reducing travel. Other topics considered in this session included the potential for improved telecommunication from fiber optics, what degree synergistic potential there is between development and telecommunication, and the potential secondary effect on real estate of such synergism.”

“The final session of this workshop dealt with the effects of telecommunication on urban design and regional form. Of particular concern was the potential for telecommunication to exacerbate suburban sprawl development to the degree that distance and place may no longer impede human interaction. On the positive side it was suggested that telecommunication could be a development tool, facilitating interaction where development is desired. The differences in effects by scale and extent were also considered.”

14 Green Development

(Tetra Tech, 1996: Executive Summary)

“Many communities dealing with intense urban development are faced with new challenges in implementing environmental protection and water quality-based controls while trying to meet conflicting expectations and the multi-objective preferences of the local public, developers, and environmentalists. To address this challenging and continuously changing issue, the United States Environmental Protection Agency Office of Wetlands, Oceans, and Watersheds is promoting green development approaches as alternatives to practices shown to adversely impact surface waters. These green approaches make use of existing environmental resources to control erosion, sediment, and flow from construction and new development. The green development approaches are considered as a part of zoning, site planning, clearing and grading, protection of sensitive resources, and runoff management.

“Through literature compilation, review, and analysis, EPA’s Oceans and Coastal Protection Division (OCPD) and Assessment and Watershed Protection Division (AWPD) hope to identify common problems with urban development practices, encourage cooperation among resources managers and integrate solutions across a variety of stakeholders and perspectives. Included are:

- problems with typical site-planning and storm water management structural and non-structural source control options and their importance to the overall development design
- sustainable development
- various regulations shaping site planning efforts
- federal, state, and local issues pertaining to grading, sediment control, stormwater management, wetlands, tree conservation, waterway construction
- importance of identifying tools available to collect and process information, application of tools, collection of data, processing and displaying data, and analysis of quantitative and qualitative results
- proposed innovative approaches for urban site-planning and design

“This document is a cumulation of examples, case studies, and issues related to implementing green development approaches in urban areas”

15. Impact of VRE on Land Use in Northern Virginia (Northern Virginia Planning District Commission, 1993: Executive Summary)

“A new commuter rail system — the Virginia Railway Express (VRE) — began operations in Northern Virginia in mid-1992. The new VRE operated four trains each over two existing rail lines running through metropolitan fringe areas to downtown Washington, DC. Initial operations provided for one-way service during the morning and evening commuting hours. The system ran through a cross-section of suburban land use activities: rural areas, protected watersheds, typical 1960s - 1980s suburban neighborhoods, small cities and towns, and densely developed urban areas.

“Local officials and planners were interested in potential impacts that a new commuter rail system might have on highway congestion relief, land use changes and local economic development. Consultants and the federal transportation agencies could provide projections of traffic relief impacts, but they had no study data available on resulting impacts of new commuter rail systems on land activity and economic development in suburban areas. Thus, Northern Virginia provided an ideal setting in which to observe any land use and activity changes which might result from introduction of commuter rail into a developing suburban area. Information on land use-related changes derived from observations in

Northern Virginia could benefit other suburban areas considering commuter rail systems in the future. The communities would better understand the potential linkages between commuter rail service, the attraction of the rail corridor, and the suburbanization process. This report may assist these communities to be better prepared to encourage or manage expected changes.

“The purpose of this study is to establish the starting point, identify variables and document base conditions in Northern Virginia against which future conditions will be compared. The process requires a second step. A future Phase II will re-examine the same variables, make comparisons to the base line conditions, identify changes and attempt to determine the changes which resulted from introduction and operations of the VRE.”

A series of basic questions were identified for guiding Phases I and II of this study process. Data variables relating to the questions were then selected for monitoring. The study process was organized around the hypothesis that introducing a new commuter rail system into a suburban setting may result in future land use-related changes which might not otherwise have occurred. A methodology was selected to help identify what those specific rail-related land use and land activity changes might be and how to monitor their geographic distribution.

“Land use plans, land use acreage and densities, transportation policies, zoning amendment applications, new residential building permits, localized employment by SIC code and similar variables were identified for monitoring. The selected study methodology defined a second of three impact areas radiating from the 12 commuter rail stations. The purpose of the defined areas was to help track the geographical extent of resulting land use changes. Data from nine primary study area jurisdictions were collected for the period 1984 to mid-1992, the base period selected for establishing base line conditions or trends. Data were aggregated within the defined areas, where possible, to facilitate future comparisons. Surveys were used to obtain information on change decisions, on ‘impressions’ of potential impacts, on commuter rail influence on home purchase decisions, and on actual VRE ridership characteristics compared to initial study hypotheses.

“Major findings should not be expected from a ‘base line’ study. The purpose of the base line study is to provide a basis against which to evaluate future conditions. Analysis of the point data, trend information and the ‘soft (qualitative) data’ impressions obtained from survey results did enable certain implications to be drawn regarding the potential for land use changes from introduction of commuter rail in Northern Virginia. The

base line data indicated the following preliminary implications:

- The size of ridership catchment areas is smaller in more densely developed suburban areas and increases in diameter toward the terminus points in the more rural areas, creating a 'tear-drop- shape. In this study area, a radius of five miles contained 80 percent of VRE ridership in more densely developed suburban areas. In less densely developed areas, a radius of 10 miles was necessary to contain 80 percent of VRE ridership.
- In surveys of persons familiar with the VRE, 34 percent indicated that two miles or less in distance was considered 'near' a VRE station; an additional 36 percent felt up to five miles was 'near.' In the same surveys, 84 percent of respondents defined 15 minutes or less in travel time from a commuter rail station as 'near.' These distances and travel time have major implications for residential planning and development and their perceived accessibility to commuter rail services.
- Some home purchasers began to make housing location choices based on *potential* access to future commuter rail service the same year — 1984 — that the actions to begin system development were initiated.
- The influence of potential commuter service access on housing location choices increased as opening of the system approached. The percentage of surveyed home purchasers who stated that access to commuter rail had been either a 'major' or 'some' consideration in their housing location choice increased from six percent among surveyed purchasers in 1984 to 43 percent among surveyed home purchasers in 1992.
- The percentage of surveyed home purchasers whose locational choices were influenced by future access to commuter rail and who used the VRE were significantly higher — 17 percent versus six percent — than for all home purchasers surveyed.
- Surveys of developers of new residential projects which used commuter rail access in their marketing programs showed their products were designed primarily for two-wage earner households with combined incomes of \$75,000+ per year. This targeted purchaser profile showed that the private sector linked commuter rail usage more with above

average income households than with commuter service for low- and moderate-income households.

- There was agreement by 77 percent of surveyed persons of various informed sectors that shuttle or feeder services to commuter stations would increase the attractiveness of nearby land for development purposes.
- The land use plans of cities with downtown commuter rail stations saw them as stimuli for attracting more customers to the downtowns and for generating new service businesses over the long term. The communities had first to provide the zoning, parking, and connecting infrastructure (sidewalks, signage, lighting, landscaping) between the stations and existing businesses which would encourage commuters to stay and visit downtown.
- Development in Northern Virginia has tended to follow major highway corridors. Commuter rail has now been added in two of the major commuting corridors — the I-95/Route 1 corridor and parallel to the I-66 corridor. It will be difficult to clearly separate access corridor-induced development from the impacts of commuter rail-associated land use changes.
- Preliminary air quality emissions reductions were calculated from changes shown in commuter travel models from VRE Ridership Survey data of September 22, 1992. Based on those ridership levels, converting from single occupancy vehicle usage to use of the VRE showed preliminary reductions in carbon monoxide (CO) emissions of nine tons, in volatile organic compound (VOC) emissions of 0.4 tons and an increase in nitrogen oxide (NO_x) emissions of 0.6 tons for the day of the survey. (VOCs are the controlling pollutant in smog formation in the Washington metropolitan area.) Automotive reductions achieved in nitrogen oxide emissions were offset by higher levels of the same emission from the VRE locomotives.
- By the third month of VRE operations, approximately 63 percent of the 2,348 surveyed VRE riders were persons who had used single occupancy vehicles (SOVs) for much or all of their previous commutes; even more significantly, those shifts by previous SOV commuters were responsible for almost 92 percent of the above-cited reductions in automobile emissions.”

16. Design for Efficient Suburban Activity Centers

(Calthorpe Associates, et al., 1996: From Introduction)

“Since the end of the second World War, suburbia has been the primary venue for residential and office growth in the U.S. and has played a critical role in shaping the quality and character of the country’s regions. As growth has moved further from traditional city centers, travel and land use patterns have changed substantially. This study focuses on Suburban Activity Centers (SACs) — a component of suburban growth whereby commercial and employment-generating uses are concentrated into developments whose influence rivals that of a region’s downtown. The advent of SACs has not only altered the way regions function, but also has long-term implications for funding and planning priorities.

“This report has been prepared for the ‘Design for Efficient Suburban Activity Centers’ project sponsored by the Federal Highway Administration. The overall purpose of the study is to identify methods for designing Activity Centers so that they minimize traffic congestion, improve pedestrian, bicycle, and transit mode shares and contribute to healthy regions.”

“This report describes the status of research on Suburban Activity Centers and suggests methods for designing new SACs or retrofitting existing SACs. It is designed to be easy to use for a variety of audiences: public agency staff who may be planning for or reviewing plans of Activity Centers; developers building a portion of an Activity Center; transportation planners working to bring transit to an Activity Center; policy planners helping to refine incentive programs; or local community advocates hoping to improve the livability of their region.”

“The report is organized as follows:”

- **Chapter 1: Introduction**

“An overview of the study and organization of the document.”

- **Chapter 2: The Impact of Suburban Activity Centers**

“Background on the role of SACs in the development of American regions, as well as a working definition of SACs.”

- **Chapter 3: Previous Research on Suburban Activity Centers**

“A review of the literature prepared to date on SACs, including travel behavior patterns, suggested methods of retrofitting auto-oriented

SACs, and alternative planning and design methods such as Transit-Oriented Development and Travel Demand Management.

- **Chapter 4: Features of an Efficient Suburban Activity Center**

“The research demonstrates that a mix of quantitative and qualitative factors should be combined to create more efficient Activity Centers. This section identifies physical design and management elements.”

- **Chapter 5: Redefining SACs — Design Principles for Efficient Suburban Activity Centers**

“A series of physical design principles that can be used to plan new Activity Centers, retrofit an existing center, or review plans for a proposed project.”

- **Chapter 6: Implementation Strategies**

“A menu of tools to implement the concepts presented in Chapter 5 are described. They are organized according to the entity most likely to use them: Federal, State, or Local agency.”

- **Chapter 7: Case Studies**

“Six activity Centers are analyzed that are considered ‘exemplary.’ Factors that were considered keys to their success are identified.”

17. Integrating Transportation and Land Use Planning
(Obermayer, Stover, and Dresser, 1994: Abstract)

“Changes in the transportation system have a large influence on urban development patterns. The location, type, and intensity of urban land uses also affect the urban street and highway system. Various federal and state initiatives have been taken to more closely link transportation and land use. These include the following:

- The Traffic Congestion Management System (CMS) mandated by the Intermodal Surface Transportation Efficiency Act (ISTEA). The CMS regulators specifically state that state and local agencies must address existing congestion and avoid potential future congestion. This clearly implies that the impact of land use and development decisions on transportation must be more effectively addressed than in the past.
- State-mandated growth management requirements such as those in Oregon, Washington, Florida, and Vermont.

- State-mandated local planning which must meet state criteria as those in Florida, Hawaii, Maine, New Jersey, Rhode Island, and Oregon.
- State-mandated congestion management which requires that the impact of proposed development must be assessed and provides penalties if development that degrades congestion is approved by a local government (California).
- Access management practices administered by the state highway agency which are designed to protect the public investment in major state roadways (Colorado, Florida, and New Jersey).

“In order to address traffic congestion problems, many municipalities have implemented travel demand ordinances which are intended to reduce drive-alone auto use and encourage ridesharing and transit. In other locations, such requirements have been, or are being, implemented in response to federal clean air requirements.”

The chapters within this document discuss:

- The transportation/land use problem (environmental implications, economic implications, impacts of ISTEA, and growth management);
 - Transportation and land use planning (transportation/land use link, local transportation and land use planning, separation of transportation and land use planning, state-level transportation and land use planning, and development of statewide land use controls);
 - Emergence of growth management (history and land use problems driving growth management);
 - Growth management and the comprehensive planning process (mandated planning without state-level enforcement, mandated planning with state-level enforcement, and state regulatory planning);
 - Implementing transportation and land use strategies (zoning, corridor overlay zones, retrofitting nonconforming properties, subdivision regulations, performance standards, congestion management systems. Federal requirements, access management, trip reduction ordinances, and urban growth boundaries).
- 18. Investigation of Land Use, Development, and Parking Policies to Support the Use of High-Occupancy Vehicles in Texas**
(Turnbull, Turner, and Lindquist, 1995: Abstract)

“This research study examined the factors that influenced commuting behavior, the reaction of commuters to various strategies and techniques to encourage alternative commute modes, and the use of different programs by public agencies and businesses in Texas. This was accomplished through a state-of-the-art literature review; discussion groups with representatives from the public and private sectors in Dallas, Houston, and Austin; an evaluation of the Houston Employer Trip Reduction Plans; and surveys of bus riders, carpoolers, and motorists on HOV lanes and freeways in Dallas and Houston. The research results identify the strategies that appear most appropriate for further application in Texas and potential implementation techniques. The results indicate that voluntary efforts are favored over mandatory programs. Further, support was strongest for transit services and supporting facilities, ridesharing, employee incentives, and on-site amenities. Less support was voiced for pricing strategies, including congestion pricing, increasing parking rates, and raising the tax on gasoline.”

19. Predicting the Effects of Roadway Improvements on Land Use and Traffic Volumes

(Chui, Memmott, and Buffington, 1983: Abstract)

“With the dwindling of fundings for new highway construction, greater efforts have to be placed on maintaining and improving existing facilities. The impact of any capacity improvement on adjacent land use or on traffic volume growth rates is a subject of concern to transportation officials. Previous studies on the subject do not draw conclusive results because of small data sets used. The present study attempts to study the same subject by constructing two regression models using an expanded data base. The first model is a land use regression model which relates each land use, in percentage of total acreage, to time. In addition to capacity improvements, factors affecting the relationship include median treatments, neighboring traffic, highway type and city differences. Estimation by Ordinary Least Squares, OLS, reveals that both capacity and median improvements impact adjacent land use and that the impact varies according to the type of land use. Based on estimated results, a procedure for predicting land use is outlined and an example is given.

“The second model is a traffic volume regression model that relates ADT to time. In addition to factors studied in the land use prediction model, the stage of area development is added. A log-log function is used and estimated by OLS. Results indicate that while any capacity improvement induces additional traffic, any median treatment hinders it. Also ADT is found to grow faster in less developed areas. By applying the regression results, a procedure for predicting ADT is developed and outlined. An example is given for its application.

“Both models are seen to be useful to officials who require land use or traffic volume predictions in the planning or evaluation processes.”

20. Land Value and Land Use Effects of Elevated, Depressed, and At-Grade Level Freeways in Texas

(Lewis, et al., 1997: Summary)

“The Texas Department of Transportation is continually upgrading the existing highway system in the state, especially in urban and suburban areas. Such freeway improvements are made at varying grade levels, i.e. at-grade, elevated, and depressed, depending on terrain, land use, and other variables. The current trend in design is toward elevated and depressed sections to gain additional lanes. Even though many sections of the elevated and depressed freeways have been built over the years, questions are still raised by abutting or nearby residents and businesses about the possible negative impacts of such freeways. The literature regarding land value impacts from freeways indicates that freeway grade has a consistent influence on land value, with properties adjacent to at-grade and depressed sections at higher values than elevated properties. Previous studies found that land use contributes to values, with commercial, industrial, and institutional uses favored over residential use. Further, it has been documented that properties suffer during the freeway construction stage, but values generally return to pre-construction levels after the fifth year of operation.

“A study was conducted of freeway sections in Houston, San Antonio, Lubbock, and Dallas, Texas, to determine the effect of freeway grade on land value. The findings support the trends reported in previous literature but also offer additional insights. The ‘life cycle effect,’ that freeway land values impacted by construction but rebounds thereafter, was confirmed through this analysis. Also consistent with findings from previous studies, commercial, institutional, and industrial uses tend to have higher values compared to other land uses. Regarding grade level, in the aggregate, the findings support that elevated values are less and show smaller percentage increases over pre-construction rates than properties at-grade or depressed. This study shows, however, that some residential and commercial parcels next to elevated freeways show stable to increasing values when compared to sections at other grades.”

21. Dallas Area Rapid Transit Impact Study: A Framework for Assessing Land Use and Development Impacts

(Coleman, Euritt, and Walton, 1993: Executive Summary)

“Accessibility plays a significant role in land development. Simply stated, any plot of land targeted for economic activity must be accessible both to

developmental activity and to the potential markets that such activity seeks to attract. Historically, it was this principle of accessibility that determined in each U. S. City the particular center of commercial activity, later termed the central business district (CBD).

“Now, with urban development giving way to *suburban* development, cities are increasingly exploring ways in which accessibility — through public transportation — can be used to foster economic development in these suburban areas as well. And one of the ways in which cities chart the success (or failure) of transit investment is through the land use impact study. This report, then, investigates strategies for measuring land use impacts. Its particular focus is the city of Dallas, where a starter system in the \$2.4 billion Dallas Area Rapid Transit (DART) project is currently under construction. The framework outlined in this document provides a strategy and a schedule for measuring changes in land use and development in the Dallas area.

“In weighing strategies for measuring land-use impacts, we reviewed existing transit impact studies, each selected on the basis of the quality of the impact study, system characteristics (type, size, and age), and the demographic characteristics of the city. From these existing studies some commonly used techniques were identified and then used to form the basis for the land use component of the DART impact study design.

“As the conclusions make clear, whether the DART starter system influences land use is a difficult and complex question to answer. Many factors will ultimately determine the success of its economic development plan. Interagency coordination, for example, is an important factor; how public/private opportunities are promoted is another. Other variables range from the tangible (ridership, on-time performance, operating efficiency) to the abstract (civic pride, ‘world-class-city’ status, desirable urban form).

“The DART starter line’s success will depend in part on its ability to attract new riders away from automobiles. Establishing park-and-ride lots at outlying stations is seen as one method that, given the current congestion of the Dallas freeway system, will certainly attract such riders. Another

approach is to promote, in the station areas, development that will enhance ridership.

“An important mechanism for DART’s success will be government/business joint development. Government and businesses have in the past 20 years shown their commitment to rebuilding and sustaining America’s urban areas. Encouraging examples, some of which are described in this report, are found in Washington, D.C., Denver, Portland, and Seattle.”

22. Using Historical Data to Measure Transportation Infrastructure Constraints on Land Use

(Miller and Demetsky, 1998: Abstract)

“Conventional practice for developing transportation forecasts is to calibrate a model for base year conditions and then apply the model to identify future deficiencies. These models typically begin with an assumed land use and then project future traffic volumes. To determine limitations on land development as a function of the capability of the transportation system, this research effort reversed that direction, beginning with transportation system characteristics as the independent variable and calculating employment and population as dependent variables. To evaluate this process, a case study was selected for which transportation planning data were available at three points in time over a 25-year period. This area is Charlottesville, Virginia, with imperfect snapshots of transportation and land use characteristics from 1967, 1979, and 1990.

“A five-component modeling process was developed and applied to the Charlottesville area for the 1967 base year. This initial approach made intuitive sense, was built from models suggested by the literature, and worked reasonably well on a small theoretical network. The performance of one component, however, was extremely weak and led the authors to develop a direct estimation model instead. This revised technique directly estimates zonal trip ends based on transportation system variables that are influenced by link volumes, roadway types, travel distances, and the geographical position of the zone. Additionally, the authors regressed retail employment, nonretail employment, and population to zonal trip ends. Lessons learned with 1967 data were used to calibrate the model for the 1979 base year and apply it for the 1990 forecast year. For individual zones, errors on the order of 50% were obtained, with larger values for retail employment and smaller values for nonretail employment and population. For the aggregate study area, errors between 6% and 21% were obtained.

“Suggestions about how this model formulation might be interpreted to yield land use limits as a function of traffic volumes are discussed. A simple finding for achieving convergence with the iterative entropy maximization method is stated. Recommendations for using historical data to predict the present, ensuring that these planning data are available for future efforts, and conducting a longitudinal study are presented. Issues associated with linking data from different time periods are explained.”

23. A Technical Review of Urban Land Use
(Southworth, 1995: Executive Summary)

“The continued growth of highway traffic in the United States has led to unwanted urban traffic congestion as well as to noticeable urban air quality problems. These problems include emissions covered by the 1990 Clean Air Act Amendments (CAAA) and the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), as well as carbon dioxide and related ‘greenhouse gas’ emissions. Urban travel also creates major demand for imported oil. Therefore, for economic as well as environmental reasons, transportation planning agencies at both the state and metropolitan level are focusing a good deal of attention on urban travel reduction policies. Much discussed policy instruments include those that encourage fewer trip starts, shorter trip distances, shifts to higher-occupancy vehicles or to nonvehicular modes, and shifts in the timing of trips from the more to the less congested periods of the day or week. Some analysts have concluded that in order to bring about sustainable reductions in urban traffic volumes, significant changes will be necessary in the way our households and businesses engage in daily travel. Such changes are likely to involve changes in the ways we organize and use traffic-generating and -attracting land within our urban areas. The purpose of this review is to evaluate the ability of current analytic methods and models to support both the evaluation and possibly the design of such vehicle travel reduction strategies, including those strategies involving the reorganization and use of urban land.

“The review is organized into three sections. Section 1 describes the nature of the problem we are trying to model, Section 2 reviews the state of the art in operational urban land use-transportation simulation models, and section 3 provides a critical assessment of such models as useful urban transportation planning tools. A number of areas are identified where further model development or testing is required. The following is a synopsis of each section of the review.

“Section 1 of the review describes the considerable technical difficulties associated with identifying the causes and directions of urban traffic

growth. It is concluded that to be effective, transportation planning needs to bring together an understanding of (1) how the transportation sector operates, (2) how traffic-generating and attracting land is developed, (3) how other technologies affect the demands for travel, (4) how modern companies make their siting and site relocation decisions, and (5) how the modern industrial lifestyles of today's households affect, and are in turn affected by, each of the above. Besides the complex conceptual issues involved, challenging practical issues result from the need to handle large amounts of spatially explicit data, and the need to consider a wide range of possible, and sometimes competing transportation control measures (TCM). Significant, sustainable, and socially acceptable travel reduction strategies will require careful multiyear land use planning. Given the typical time lag between the opening of a major transportation infrastructure or service and the subsequent land use response, interest is focused in this review on models capable of stimulating policy impacts anywhere from 15 to 20 years into the future"

"Section 2 reviews the current status of operational land use-transportation planning models, and in particular the development of 'integrated' urban analysis models. A listing of the most commonly referenced models is provided. The key theoretical and operational developments of the past 30 years are discussed, using the mathematical details from selected modeling systems to illustrate the range of approaches now available for simulating urban travel patterns and their multiyear impacts. Taken as a set, current models have managed to combine the entropy maximization and locational accessibility premises that are the basis of spatial interaction theory with economically rational notions of utility maximization and consumer choice. From the urban economics literature they have taken the idea of equilibration between transportation demand and supply and linked it to a residential market clearing process. Methodologically, they make use of nonlinear mathematical programming methods, interregional input-output methods, and the latest developments in econometrics and microsimulation to model jointly the demands for travel, residences, employment, services, and urban land. The more comprehensive models also simulate demographic changes in the urban population as well changes in physical stock other than transportation infrastructure, including models of the aging and renewal process associated with the urban housing market.

"The key trait these models have in common is their ability to feed back the expected results of adding new transportation infrastructure or services, computed within a transportation submodel, to a travel cost sensitive land use submodel. They simulate urban dynamics by iterating the simulated urban system through a series of discrete time intervals. Here the level of sophistication varies considerably across models: from a

simple one-shot, 30-year forecasting process, to recursive formulations which move the urban system forward in time through a series of successively updated, 1- to 5-year intervals. They model these events using an extensive database, usually resulting in the allocation of traffic volumes and speeds over detailed link-node representations of multimodal urban transportation networks. They have been used in a number of different countries to simulate a range of travel reduction strategies, including fuel and road pricing policies, the spatial reallocation of traffic-generating land uses, and the introduction of new highways and transit services.

“However, despite advancing in a number of theoretical and practical directions since Lowry’s 1964 ‘Model of Metropolis,’ these models are only now finding their way into U.S. practice. Past reticence to employ them has stemmed in part from their analytic complexity, in part from their significant data requirements and similarly significant demands on computational resources. While today’s desktop computers can now provide much of the computing power required, the other issues remain unresolved. Spurred on by the demands placed on metropolitan planners by the CAAA and supporting ISTEA legislation, these models are now receiving renewed scrutiny. At the same time, recent empirical and theoretical developments suggest that current models may need to be either adapted or replaced if realistic simulations of traveler responses to travel-reduction strategies are to be forthcoming. Here a difficulty facing model assessment is the limited information available from model validation exercises, a process exacerbated by the extended time frames required to capture the true effects on travel of the more significant land use changes.

“Section 3 considers a number of frequently voiced criticisms of currently operational models and recasts these perceived weaknesses as candidate areas for further research. Many of these criticisms are linked to continued use of the traditional four-step urban transportation planning model, and in particular, the persistence of a single-destination, single trip-purpose-based approach to travel generation. There is a widely recognized need to develop more effective ways to capture nontraditional travel reduction options, such as telecommuting and teleshopping, alternatively fueled but perhaps limited-range vehicles, and nontraditional work weeks. Improved ‘travel activity analysis’ models under development include the modeling of multideestination, multipurpose trip chains; the simulation of private vehicle use by different household members and types of households; and the simulation of daily travel schedules which recognize the growing number of noncommute, non-peak period trips which are taking place. Similarly, our treatment of the urban goods movement process lacks any underlying behavioral rationale and needs to

be tied to a more comprehensive understanding of company logistics planning. Some recent developments in both personal and goods movement modeling are referenced as useful starting points for subsequent analysis.

“Needed improvements to the land use modeling process are also discussed. In particular, and despite the frequently referenced polycentric nature of urban growth over the course of this century, there has been a failure to come to terms with the causal mechanisms underlying intraurban, notably suburban, center growth. The urban economics literature, while extensive, has so far contributed little in the way of operationally implementable theories of urban development. Among other barriers to understanding, outmoded notions of what constitutes ‘basic’ and ‘nonbasic’ employment activity make it difficult to identify the underlying causes of commercial and industrial business location decisions. A reassessment of this traditional distinction, already evident in a number of recent modeling efforts, needs to be pursued in a more comprehensive manner.

“A second area of land use planning warranting further study is a more normative, or design-based, approach to urban activity center planning. This includes approaches centered on transit-oriented development and pedestrian- and cycle-oriented land use arrangements.

“Third, a gradual move towards more behaviorally realistic, truly dynamical modeling approaches is discussed, based on differential or difference equation forms and supported by longitudinal data such as multiwave panel analysis of empirically validated travel behaviors. If such dynamical analysis can be combined with a better understanding of why and how urban centers form, and how designs of mixed use activity centers influence household and business travel patterns, we would have the basis for more realistic, and perhaps eventually prescriptive, travel activity pattern simulations.

“Finally, these urban simulation models need to be places within today’s highly interactive software environments. We need to produce not only policy-relevant, but also policy-usable analysis tools. Urban planning ought to be a highly interactive, consensus-building process. Black box models should be neither acceptable nor necessary. Models should be placed within spatially explicit decision support aids taking advantage of the latest geographic information systems and relational database technology to open up the planning process to well-informed local and regional planners. Ultimately, urban planning comes down to compromise and common sense. Yet we would be taking considerable risk, as we have often been forced to do in the past, if we were to assume away the

complexity associated with multiyear planning by selecting travel policies based largely on professional intuition. Simulation models are necessary if we are to understand the consequences of trying to control future traffic growth, and a degree of complexity in model design cannot be avoided.”

24. Transportation, Urban Form, and the Environment

(Transportation Research Board, 1991: Preface)

“The form of land use development is affected by land availability, price, topography, and transportation access, and land use patterns in turn affect travel demand characteristics. In recent years suburban activity centers have developed at locations with superior highway access, and these centers have characteristics that are very different from central business districts in the core. The form of land use development is also affected by continuing changes in economic structure, demographics, and life-style.

“If we are to develop solutions to the problem of urban congestion, it is important to gain a better understanding of the interaction between land use and transportation characteristics and between economic and demographic characteristics and land use. What are the public costs and benefits of alternative land use configurations? Can the present land use patterns be modified to produce a more efficient transportation system? What are the economic disbenefits resulting from an inadequate transportation system? What urban form or transportation strategies could best achieve such national objectives as clean air and energy conservation? What urban forms would be more efficient for a transit-oriented system and what forms would be more efficient for an automobile-oriented system? How can automobile travel demand be reduced?

“Solutions to urban congestion must increase the person-carrying capacity of the existing transportation infrastructure, provide for efficient movements of goods and land access, and at the same time address the mobility needs of an aging population and conserve energy and economic resources. To develop practical and efficient solutions, we need to analyze

- The forces that drive urban development, potential impacts of rising energy costs, renewed efforts to ensure clean air, and new technologies on future development patterns;
- Future transportation needs of the various segments of the urban travel market, including work commuters, suburban travelers, and the elderly;

- Alternative methods to serve future travel needs;
- Innovative techniques to maximize the efficiency of travel to and from scattered centers in a multinuclear urban form;
- Policies on taxes, land development, and travel demand management and their systemwide impacts and economic resource costs; and
- Impacts of transportation improvements on economic development, the environment, and social objectives.

“The status of current knowledge and gaps in knowledge with respect to the aforementioned issues must be identified in order to develop a research agenda that provides the transportation community with the tools needed to develop more efficient future transportation systems. The approach and elements of the research needed in these areas must be defined. In this conference, the intent was to develop a preliminary agenda or proposed future research. Nationally known experts in the field of transportation, land use, and demographic interaction were commissioned to provide insights into (a) how and why urban areas have become congested, (b) how urban areas may satisfy their mobility needs efficiently, and (c) what research must be undertaken to assist in analysis, development, and implementation of solutions.

“The Federal Highway Administration (FHWA) requested the Transportation Research Board to conduct a Conference on Transportation, Urban Form, and the Environment as part of FHWA’s approved High Priority National Program Area project ‘Ensuring the Efficiency of Future Urban Transportation Systems.’ The project’s overall objective is the examination of options for maintaining future urban mobility. The purpose of this conference was to bring together experts to:

- Review the status of our current knowledge with respect to recent historical trends in urban development and transportation and their interaction with economic and demographic forces;
- Discuss solutions and innovative institutional and technical approaches to provide for future urban mobility; and
- Identify research needs to aid in the analysis, development, and implementation of such solutions.

“Resource papers were commissioned on the following topics:

“**Housing and Jobs:** Deakin focused on the demand for transportation as determined by land use, demographics, and so forth. The primary focus was on issues involved in connecting origins with destinations. She included discussion of private development funding and public development-regulatory aspects.

“**Financing:** Parker addressed the public costs attributable to urban form and public financing mechanisms that affect development and determine land use. He also included developer financing and joint development issues and economic impacts.

“**Decision making:** Porter examined how the structure of institutions influences urban form and local and regional decision making. He included the politics of urban form and the differences in the land use and transportation decision making process.

“**Energy and Environment:** Burwell examined the energy requirements of urban form (particularly transportation energy), the effects of development and land use on the environment, and regional economic opportunity costs associated with different patterns of land use.

“**Options:** Brand discussed options for serving existing travel patterns, controlling demand, improving system performance, and restructuring the transportation network to better meet demand and telecommunications and telecommuting.

“**Urban Design:** Dyett focused on site design and its relationship to urban form and transportation. He emphasized design strategies that reduce travel needs and requirements related to residential and job requirements. Although emphasis was on the micro level, regional implications were considered.

“The keynote address, giving a decision maker’s viewpoint of transportation, urban form, and the environment, is also contained in these proceedings. After the resource papers were presented, the participants formed five workshop groups to discuss the same topics covered by the authors (e.g., basic understanding, relationships, methodology). A final plenary session was held at which the workshop reports were presented, followed by open discussion.

“This conference report represents the first step in a two-stage process of developing a research agenda. Findings from this conference will be expanded by the Transportation Systems Center, U.S. Department of

Transportation, in order to develop a comprehensive research agenda on the topic of transportation, urban form, and the environment.”

25. Expanding Metropolitan Highways

(Transportation Research Board, 1995b)

a. Document Executive Summary

“The Clean Air Act Amendments of 1990 (CAAA) and complementary provisions of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) introduced new constraints on the transportation sector to help ensure that transportation activities do not delay expeditious attainment of national health standards for air quality. As a result highway projects that expand capacity have come under particular scrutiny in many metropolitan areas for their potential to increase motor vehicle traffic and emissions — a primary source of air pollution. The issue is already at the center of legal challenges or threats of litigation in several metropolitan areas, potentially stalling local highway construction programs.

“For years, transportation agencies have responded to traffic growth by expanding highway capacity to maintain reasonable levels of service. Capacity expansions ranging from small-scale signal-timing improvements to construction of major highways were expected to relieve congestion without substantial negative effects on air quality. In fact, capacity enhancements that raised travel speeds and smoothed traffic flows were believed to reduce vehicle emissions and improve energy efficiency. Further, it was widely accepted that new highway capacity was essential to the continued economic growth and competitiveness of major metropolitan areas.

“These views are now being challenged. Some analyses and environmental groups argue that adding highway capacity will result in more traffic, higher emission levels, and greater energy consumption in the long run by stimulating motor vehicle travel and encouraging dispersed, automobile-oriented development. In addition they see continued highway expansion as antithetical to a more environmentally oriented and resource-conscious future that stresses the revitalization of older urban and inner suburban neighborhoods and supports transit and nonmotorized forms of transport.

“These issues are part of a larger debate over the appropriate direction of metropolitan growth and the role of transportation in that process. This debate involves value judgements about the relative importance of mobility, economic growth, environmental protection, and energy conservation. It considers a broad range of policies, from investments in

transportation supply to demand management and pricing strategies.

“This study is focused on a more specific topic: the effects of investment in highway capacity on air quality and energy use in metropolitan areas. Its primary audience is metropolitan planning organizations (MPOs), state officials, legislators, and courts with oversight responsibilities. These agencies and officials are being asked to meet the regulatory requirements of the CAAA by making judgements about the environmental effects of highway capacity expansion on the basis of their interpretation of the best available evidence. Energy issues do not convey the same urgency or require the same regulatory analysis, yet transportation’s increasing consumption of the nation’s petroleum resources is of concern. To the extent that energy efficiency and energy use are affected by changes in traffic flow characteristics and travel volume from highway capacity expansion, these effects are considered in this study.

“The purpose of this study is to review the current state of knowledge, evaluate the scientific evidence, and narrow the areas of disagreement about the impacts of highway capacity additions on traffic flow characteristics, travel demand, land use, vehicle emissions, air quality, and energy use. The state of modeling practice is also examined to assess the reliability of forecasting tools available to planning agencies; research, modeling improvements, and data collection are recommended to help narrow the gap between regulatory requirements and analytic capabilities.”

b. Land Use and Urban Form

“The concern of this chapter is whether, over the long term, increased highway capacity results in development that fosters additional motor vehicle travel and hence degrades air quality and increases energy consumption In the first section of this chapter the debate is framed against the backdrop of the influences on metropolitan decentralization. In the next three sections an overview is given of the current knowledge — from theory, empirical research, and modeling — about transportation’s effect on land use. In the fifth section the efforts to change population densities through land use and transportation policies are discussed, and the possible effect of these changes on regional air quality and energy consumption is examined. In the final two sections that chapter s summarized and recommendations are made for research to improve the ability to estimate the land use, air quality, and energy consumption consequences of expanded highway capacity.” . . .

“Highway capacity expansions are criticized because they are thought to

lead to suburban sprawl, greater automobile use, and increased energy consumption and air pollution. The factors causing the decentralization of urban areas, however, are far more complex than just the expansion of highway capacity. Highway access to outlying areas is certainly necessary to support decentralization, but rising incomes, home buyers' desire for larger homes and more land, and flight from problems in central cities have also influenced decentralization. It remains an open question whether the provision of road capacity helped cause the decentralization of urban areas or whether the demands for decentralization caused the roads to be built or expanded.

“Highway expansions, combined with prevailing land use and automobile pricing policies, have influenced the form of metropolitan development. Most metropolitan areas have grown in population and spread that population over a larger land area. This has been particularly true in the south and west over the last decade. Highway expansions have helped redistribute this growth. Capacity expansions tend to redistribute growth that would have occurred anyway, but they can result in net new growth if they stimulate productivity gains in the private sector. This can happen if an expansion allows firms to improve access to labor, capital, or markets.

“Theory predicts that a reduction in transportation costs due to an expanded highway will have decentralizing effect on residential development and both centralizing and decentralizing effects on businesses. Businesses that serve individuals tend to follow them. Businesses exporting goods and services out of the urbanized area may or may not decentralize depending on the importance of agglomeration economies and the extent to which they are labor and land intensive. The net effect of reduced transportation costs, however, will be toward decentralization.

“Early case studies indicated that highway investments had powerful effects on land values and suburban development. More recent studies of major highway and transit investments do not indicate large effects. Analysts have advanced a number of reasons why transportation investments in recent decades have small effects on land use. Part of the problem is methodological. The cause-and-effect relationships are difficult to distinguish, even with sophisticated statistical techniques. Moreover, the impacts affect subsequent development for many decades, but most studies examine short-term consequences.

“There are practical reasons why highway capacity expansions have relatively minor effects, at least over a 5- to 10- year period. The out-of-pocket cost of transportation is low (and falling), which reduces the importance of location relative to other preferences. It could be that once

a basic level of accessibility is established, other preferences — for housing, neighborhood, or schools — take precedence (Giuliano 1989b). In addition, the transportation infrastructure in large urbanized areas is extensive and affords a high degree of personal mobility. Even substantial new investments in capacity will make only incremental changes in the infrastructure and will therefore have small effects on regional land use. (The effects within specific corridors, however, can be substantial.)” . . .

“Policies that encourage higher residential densities are being pursued in some metropolitan areas to reduce automobile use. Given the prevailing use of automobiles — and the subsidies that encourage their use (e.g., subsidized parking) — it would take large increases in density for trip making to shift from automobiles to other modes. Modest increases in density can reduce the amount of automobile travel, but the density of the average urbanized area would have to more than double to significantly affect mode choice. Moreover, most development is occurring on the periphery of urbanized areas, where the existing densities are far lower than within the urbanized area. Current policies and practices in most metropolitan areas make changes in density sufficient to affect mode choice and regional air quality difficult to achieve. Neighborhoods resist measures to increase density or to provide mixed uses, and close-in suburbs impose growth restrictions or use zoning practices that force development farther out. Efforts to reduce automobile use and improve regional air quality will have more potential if society is willing to make major changes in land use planning at the regional level and to fully price the use of the highway system.”

26. An Evaluation of the Relationships Between Transit and Urban Form

(Transportation Research Board, 1995a)

a. Summary of Transit Impacts on Urban Form and Land Use

“Thirty years of case studies and historical research have documented the role that transit has played in the growth and development of cities and metropolitan areas since the late 1800s.

- Large portions of our older cities have been shaped by streetcar and subway lines. Transit no longer has the ability to shape urban form the way it did in the streetcar and subway era when transit vastly increased the portions of regions accessible to downtowns. Nonetheless, today’s rail transit investments can strengthen downtowns while also encouraging decentralization and multinucleation in the suburbs.

- Urban rail transit investments rarely ‘create’ new growth, but more typically redistribute growth that would have taken place without the investment.
- In most metropolitan areas with heavy and light rail systems, the greatest land-use changes have occurred downtown, in the form of redeveloped land and new office, commercial, and institutional development. San Francisco, California; Toronto, Ontario; Washington, DC; Buffalo, New York; San Diego, California; and Portland, Oregon provide examples. The strengthening of downtowns stems in part from the fact that downtowns are the hubs of all rail systems.
- New rail systems have also been a force toward decentralization of population and employment, rather than toward urban containment. Large subcenters or ‘edge cities,’ have formed around stations in a number of North American rail cities — Washington Metro: Ballston, Bethesda, Silver Spring; Toronto: Scarborough, North York; San Francisco: Walnut Creek, Concord; Atlanta: Lenox Square, Buckhead; Vancouver: Burnaby, New Westminster; Miami: South Dadeland.
- There have been fewer changes in residential land uses than in commercial land uses as a result of rail investments. Some apartment construction has occurred near suburban rail stations in Washington, DC, Philadelphia, Toronto, San Francisco, San Diego, and other cities. There are a number of barriers to higher density residential development near rail stations, including community opposition and weak markets for multifamily housing. However, there is evidence that accessibility to rail becomes capitalized into higher residential land values.
- The urban form and land-use impacts of light rail, busways, and conventional bus transit have generally been weaker than those of heavy rail systems because the systems usually confer less accessibility advantages, at least relative to the main competition — the highway system.
- In general, transit investments and services are incapable by themselves of bringing about significant and lasting land-use and urban form changes without public policies that leverage these investments and the pressure of such forces as a rapidly expanding regional economy. Experiences in Europe and Canada underscore the importance of coupling rail investments with reinforcing local policies such as upzoning around stations, supplemental acquisition,

joint development of station-area land, and situating publicly provided housing near stations.”

b. Summary of Urban Form and Land-Use Impacts on Transit Demand

“Understanding how the densities, settlement patterns, land-use compositions, and urban designs of cities and neighborhoods influence transit usage is of vital importance to transit planners and decision makers. Whether a future light rail extension will be a cost-effective investment or whether headways should be increased on a conventional bus route hinges critically on whether the built environment and the people living and working there will support these changes with their patronage.

- The key domestic study on the influence of urban form on transit demand (Pushkarev and Zupan) identified a set of relationships between residential densities in transit corridors and levels of travel patronage. In addition, significant relationships were found between the size and extensiveness of employment centers and transit patronage in corridors leading to the employment centers. This research focused principally on the New York metropolitan area and was based on travel data that is 20 to 30 years old.
- Recently, regional planning bodies have used simulation models to assess the impact of various growth scenarios on future travel behavior in their regions. Most find that concentrating jobs and housing where they can be served by transit increases transit mode shares and reduces vehicle miles traveled, but these effects are diluted by the fact that two-thirds or more of the forecast-year development is already in place.
- International work has documented strong relationships between urban densities and energy consumption in metropolitan areas. In addition, European cities have settlement patterns that are substantially denser and more mixed in character than American cities. Europeans also ride transit, walk, and bicycle more than Americans.
- At an intermediate scale, dense office and residential activity centers generate larger numbers of transit trips for work and non-work purposes than do less dense, auto-oriented suburban activity centers. Less dense, less diverse suburban activity centers generate far higher numbers of vehicle trips and lower levels of auto occupancy, particularly when combined with abundant, free parking.

The inclusion of retail and service activities in traditional suburban office developments can reduce auto dependency.

- Paired comparisons of pre-war transit-oriented communities that feature in-neighborhood retail service and modified-grid streets with post-war auto-oriented planned subdivisions suggest that transit-supportive environments can induce more walking and transit trips.
- Residential density and design influences travel behavior directly, but in a less powerful way than the socioeconomic characteristics of residents. Different types of households live in dense and spacious areas within metropolitan regions. In American cities, affluent residents seek space at the metropolitan fringe, while in European cities, affluent residents often seek amenities and more central locations.
- At the same neighborhood and station-area scale, transit has been shown to draw pedestrian patrons from up to 4,000 ft. Surveys in Washington, DC, San Francisco, and elsewhere indicate significant transit trip generation rates from residential development proximate to rail stations, especially for systems and regions in which both housing and employment are found adjacent to transit.
- Pedestrian travel in both employment and residential areas can be induced and pedestrian trips lengthened by the provision of extensive and attractive pedestrian amenities.
- Local jurisdictions and transit agencies are increasingly developing design guidelines to support alternatives to the automobile, but specific features of successful transit-oriented site designs have yet to be demonstrated empirically.”

c. Summary of Impacts of Transit and Urban Form

“While it is acknowledged that transit and urban form interact and influence each other simultaneously, these relationships are extremely difficult to document without interactive transportation and land use models. Work done with an interactive model in Seattle suggests that regional land-use patterns organized around multiple centers and supported by high-capacity transit will generate a reduction in automobile dependence and an increase in transit utilization. Additional research is underway on this topic.”

d. Summary of Research in Progress

“Important research is in progress on both the effects of transit on urban form and the effects of land use patterns on transit demand. The impacts of transit on urban form are focusing on the macroscale with updates of studies on the impacts of the second generation of heavy rail systems on regional form. Work on the impacts of land use on travel demand is going on at all scales of development. One can expect increases in knowledge in this area in the next several years.”

e. Conclusions and Implications for Further Research

“Several decades of research regarding the influence of transit on urban and metropolitan form have led to the emergence of some consensus on the nature of this relationship. In contrast, research on the ways in which land use and urban form influence travel behavior and transit patronage is a less settled question. Data on the influence of land use at the corridor level and metropolitan level are relatively out of date. Research on the effects of the built environment at the site level on travel behavior is incomplete.”

27. Land Development Regulations that Promote Access Management

(Williams and Forester, 1996: Summary)

“Contemporary access management is a comprehensive approach for improving traffic operations by managing the location, design, and operation of driveways, median openings, and street connections to a roadway. It calls for establishing a logical, functional hierarchy of roadways and for reinforcing that hierarchy by applying various levels of access control. Roadways are classified for access control based on their importance to regional mobility.

“Research on comprehensive state access management programs is documenting the safety and operational benefits of access management. These benefits include the potential for reducing access related accidents and preserving the efficiency of roadways in terms of capacity and speed. As a method of protecting the level of service of existing facilities, access management helps to stabilize public expenditures for roads and highways. Reducing the number and frequency of curb cuts or median openings also creates aesthetic benefits, such as more area that may be used for landscaping.

“Recognition of these benefits has elevated access management to a policy level. The Intermodal Surface Transportation Efficiency Act of 1991

recommends consideration of access management for congestion management and corridor preservation. States are developing more comprehensive access management programs and strategic highway initiatives that emphasize access control. Metropolitan planning organizations are incorporating access management into their corridor plans, congestion management programs, and safety management systems. A more comprehensive approach to access management is also emerging at the local level — beginning with the comprehensive plan, extending to specific planning studies, and encompassing a broader range of land management strategies.

“Access management can also advance growth management objectives. Discouraging urban sprawl, maintaining roadway level of service, protection community character, and coordination and consistency of land use and transportation decisions are areas where access management and growth management converge. For example, access management can be facilitated through land use strategies that discourage strip development and promote clustering of land uses into unified developments with shared access systems. These same techniques address some defining characteristics of sprawl — strip development and inadequate connectivity among land uses.

“Access management considerations also extend to transit, bicycle, and pedestrian access. Bus pullout bays at transfer points reduce vehicular conflicts and help preserve traffic flow. Clustering transit compatible uses around a bus turnaround or locating buildings near the street line with parking in the rear, provides more direct pedestrian and transit access and promotes shared access. Minor changes in a subdivision layout can improve route productivity by providing more direct transit routes.

“Competing objectives and inadequate coordination of transportation and land development practices continue to impede access management. State and regional agencies have difficulty achieving access management objectives without collaboration at the local level where land development decisions are made. Alternatively, local access management initiatives are sometimes undermined by inadequacies in state driveway permitting requirements or administrative procedures. The diversity of access related standards across jurisdictions and agencies adds another dimension to the coordination challenge.

“Some state departments of transportation have taken the lead in coordinating intergovernmental efforts to achieve access management objectives. In metropolitan areas, some metropolitan planning organizations or councils of government are assuming this role. Regional corridor plans, intergovernmental agreements, access management

plans, joint policy resolutions, and procedures for coordinated development review are among the coordination techniques applied by agencies reviewed for the synthesis.

“Public involvement techniques are also proving effective as a method for reducing interagency conflicts, resolving public concerns, and surmounting political constraints. The Capital Area Conflict of Governments in Hartford, Connecticut, is among a growing number of agencies that are integrating public involvement strategies into their access management efforts. Their work program for corridor management plans calls for special corridor committees from each affected municipality, newsletters to keep people informed along the way, and special meetings with citizens and local policy makers at key steps in the decision-making process.

“The review of current regulatory practice reveals some components of effective access management policies. These include driveway spacing and corner clearance standards, geometric design standards, and traffic impact analysis requirements. Most local access management policies encourage consolidation of driveways or joint and cross access, but some contemporary codes are requiring joint access where driveway spacing cannot be achieved. Retrofitting conditions are included to bring nonconforming driveways into conformance. Like nonconforming use requirements in zoning, these conditions are typically triggered when a property is redeveloped or improved.

“The interdependence of land division and access controls is another important dimension of regulating access. Subdivision regulations, lot split requirements, and development review provide an opportunity to assure proper access and street layout in relation to existing or planned roadways. Attention to lot width, depth, and size in zoning helps ensure adequate dimensions for on-site circulation, parking, driveway spacing, driveway throat length, corner clearance, and service drives. Setbacks affect the ability to achieve adequate sight distance and avoid placement of structures within future rights-of-way. Private road regulations and restrictions on flag lots or privately owned access easements address substandard private roads and related land division problems.

“Local methods of regulating access vary widely. Some communities apply access management requirements only to designated corridors through a corridor overlay ordinance, allowing them to target access standards to the unique circumstances of a specific corridor. Service drive requirements have also been added to planned unit development zoning and applied to developing commercial corridors. Other communities integrate access management principles and regulations into

their entire planning and regulatory program.

“Flexibility is being achieved largely on an administrative level through waivers, special exceptions, and variances. Such provisions allow agencies to optimize driveway location, while responding to the diverse circumstances in the built environment. Some communities establish a flexibility threshold where spacing standards prove impractical, such as up to 20 percent reduction in spacing or no less than the spacing of the next lowest access classification. Some also offer flexibility in parking or lot dimensional requirements to property owners who agree to consolidate driveways.

“Local authority to engage in access control is implied under the general police power, unless expressly provided through statute. Although recent court decisions have clarified the rules of regulatory practice, local governments may still impose reasonable conditions on development. Access management strategies, such as joint access or service drives, have been upheld where they are equitably administered, because they bear a reasonable and roughly proportional relationship to the impacts of development. A consistent planning and regulatory program strengthens the legal basis for access management decisions.”

28. Coordination of Transportation System Management and Land Use Management (Engelen, 1982)

“The coordination of transportation system management (TSM) and land use management (LUM) can take place in individual projects, for an area or along a route, or at the program level where continuous efforts are made to assure compatibility in the relationships between transportation and land use. Much coordination takes place in communities with comprehensive planning programs where land use and streets are planned to complement one another and zoning and other regulations are designed to implement plans and protect transportation. However, there is little documentation of this coordination or of the coordination at the area or route levels.

“It has long been recognized that there are strong relationships between transportation and land use. The coordination of transportation and land use is a primary objective of comprehensive planning: many zoning controls and land use regulations are designed to match land use to transportation or to serve transportation objectives. The decline in financial resources available for transportation and the increased emphasis on the management of existing facilities have increased the need to avoid conflicts between traffic and land use.

“The type and number of actions that might be taken to meet the objectives of TSM or LUM are limited only by imagination and by the nature of the problem to be resolved. The actions fall into four categories: (a) control/develop land, (b) control access to transportation, (c) control physical features of transportation, and (d) control or influence transportation system use.

“Possible applications for coordination of TSM and LUM, with specific examples of current practice where available, for each of nine operating environments (major employment sites, major activity centers, outlying commercial centers, neighborhoods, central business districts, regions, arterial corridors, freeway corridors, and modal transfer points) are discussed in this synthesis.

“The advantages of coordinating TSM and LUM have been recognized for years; many of the concepts and principles built into zoning and subdivision regulations are based on this recognition, although the concepts and principles are not always applied. One of the major factors standing in the way of coordination is lack of understanding of the economic benefits, particularly in developed areas. Another factor is the separation of funds used for transportation and land development. To overcome these obstacles, research is needed to demonstrate the importance and value of the benefits of coordination. In addition, funding mechanisms are needed for equitable distribution of costs in relation to benefits.”

29. Transit-Friendly Streets (Project for Public Spaces, 1998)

“In Phase I of the TCRP H-4D project research program (‘The Role of Transit in Creating Livable Metropolitan Communities,’ TCRP Report 22), Project for Public Spaces, Inc. (PPS) focused on the important part that transit is playing in fostering community livability and the specific ways that transit is acting as a catalyst for community improvement. Livability concerns of communities—such as generating economic opportunities, revitalizing downtowns and neighborhoods, improving safety and image, and making communities more accessible and convenient—were correlated with transit services and facilities in cities across the United States. Opportunities for transit to work in partnership with communities in order to leverage limited transit dollars also were investigated.

“This Phase II report addresses the connection between transit and streets, recognizing that the design and management of streets and traffic can and does affect the livability of communities. This report presents the strategies that are emerging across the United States, where the effective,

balanced incorporation of transit into city streets is having a positive impact on livability and quality of life.

“Concerns about livability affect every community: inner cities, suburbs, small towns, and rural areas. This study adopts a ‘place-making’ approach to creating transit-friendly streets, where a local community, working in partnership with a transit agency, plans and implements neighborhood-scale projects and programs that are mutually supportive of community livability and transit ridership goals.

“Chapter 2 defines the term ‘transit-friendly streets’ and describes it from both an American and European perspective. Techniques for balancing street uses among various modes, such as traffic calming, are briefly discussed.

“Chapter 3 presents case studies of five cities (Portland, Oregon; Rochester, New York; San Francisco, California; Ann Arbor, Michigan; and Somerville, Massachusetts) with transit-friendly streets that achieve community livability goals; the role played by communities, transit agencies, municipal agencies and authorities, and the federal government is also discussed. The introduction to Chapter 3 describes the selection criteria for case studies and the research approach used to collect the data and background information for the case studies.

“Chapter 4 presents a more in-depth discussion of methods and strategies to create transit-friendly streets. The issues presented by each of the case studies and the strategies used to address them are summarized and examples are provided where specific street design and traffic management techniques were successfully employed. The chapter also provides a checklist of design, management, and transit strategies and describes how they can be used to address specific local problems as part of a ‘place-making’ process.

“Chapter 5 concludes by tying the report findings back to the issue of livability, with a discussion of directions for future research.

“A bibliography, the results of the surveys conducted, a matrix of other transit-friendly street projects and a list of interviewees for the project can be found in the Appendices.”

30. The Costs of Sprawl — Revisited (Burchell, et al., 1998)

“TCRP Report 39 will be of interest to individuals involved in ongoing discussions and debates about urban sprawl and its effects. This reports

is a literature review that represents the culmination of the first phase of the TCRP Project H-10, 'The Costs of Sprawl--Revisited.' The report was prepared by Rutgers University's Center for Urban Policy Research, in conjunction with The Brookings Institution, Parsons Brinckerhoff Quade and Douglas, Inc., and ECONorthwest. Urban sprawl is a topic that interests urban planners, economists, environmentalists, sociologists, transportation professionals, policymakers and public officials, academics in many fields, and the general public.

"Regardless of the focus of any particular debate or discussion on urban sprawl, most such discussions attempt to define sprawl and address whether it is 'good' or 'bad.' Consequently, Chapter 1 of Section I of TCRP Report 39 provides a working definition of sprawl and its associated costs. The next chapter provides historical discussion, dating back to the early 1920s when zoning acts were initially developed, and to the 1950s when the term 'sprawl' entered the planning literature. As indicated by the title of this research project, the seminal 1974 report *The Costs of Sprawl*, prepared by the Real Estate Research Corporation, serves as a springboard for this research effort.

"Section II of the report contains the Literature Synthesis. This section systematically presents the literature on sprawl in chapters that focus on the following major areas of impact:

- Public/private capital and operating costs,
- Transportation and travel costs,
- Land/natural habitat preservation,
- Quality of life, and
- Social issues.

"Throughout this section, the research team discusses the literature and identifies the extent to which there is agreement and disagreement about the premises and conclusions.

"Section III of the report presents annotations of studies, organize in chapters that focus on the same five major impact areas as Section II.

"While this report will not resolve the debate on the benefits and costs of urban sprawl, it provides an important repository of information for the debaters."

31. Transit and Urban Form — Volume 1

(Parsons Brinckerhoff Quade and Douglas, 1996)

a. Part I: Transit, Urban Form, and the Built Environment:

A Summary of Knowledge

“The purpose of this report is to summarize the findings and conclusions of TCRP Project H-1, Transit and Urban Form, with the large body of literature described in the literature review (TCRP Research Results Digest, No. 7, June 1995). In order not to duplicate the literature review, the researchers focus on a relatively small number of studies, most of them completed within the last 5 years, on the ways in which ‘urban form’ and public transportation interact.”

(1) How Urban Form Influences Transit Demand

“How do characteristics of urban form [e.g., residential density, Central Business District (CBD) employment size and density] influence the demand cost for light rail and commuter rail transit and the cost of providing that service?

- Data used: Light rail boardings and transit information from 11 light rail cities with 19 lines. Commuter rail boardings and transit information from 6 commuter rail cities with 47 lines. Employment and population characteristics from 1990 Census. Cost information from Federal Transit Administration reports, 1993 National Transit Database, and transit agencies.
- Main findings: Residential densities have a significant influence on rail transit station boardings. Residential densities have more influence on light rail ridership and costs than on commuter rail. Both the size and the density of the CBD influence light rail ridership. CBD density is more important for supporting commuter rail ridership than light rail ridership. Other factors within the control of transit agencies, such as the availability of feeder bus service and park-and-ride lots, also influence ridership.
- Product: *Commuter and Light Rail Transit Corridors : The Land Use Connection* (Volume I, Part II of this report).

“How does the built environment near rail transit stations affect the mode of access and the size of the catchment area?

- Data used: Transit, regional land uses, and 1990 census data for Chicago [Metra commuter rail and Chicago Transit Authority (CTA) rapid rail] and San Francisco [Bay Area Rapid Transit (BART)].
- Main findings: Residents of higher density residential areas are more likely to walk to transit. Nearly all commuters walk to their

destinations in CBDs, but 25 to 50 percent ride buses at other destinations. Use of feeder bus service depends mainly on the level of service and parking supplies, not on the built environment. Catchment areas are larger in more suburban areas and areas where parking is ample.

- Product: *Mode of Access and Catchment Areas for Rail Transit* (unpublished).

“Do neighborhood land use mix and urban design influence the demand for transit?”

- Data used: American Housing Survey for 1985. Transit and land use data for Chicago. Mail survey of residents and field observation of urban design in 12 East Bay census tracts in San Francisco area.
- Main findings: The types and mix of land uses influence the demand for transit as well as the use of nonmotorized modes. Residents of ‘traditional’ neighborhoods (i.e., pre-1950) are more likely to use nonautomotive modes for non work trips than residents of ‘suburban’ neighborhoods (i.e., post-1950). It is difficult to sort out the effects of land use mix and urban design because they are strongly correlated with density.
- Product: *Influence of Land Use Mix and Neighborhood Design on Transit Demand* (unpublished).”

(2) How Transit Influences Land Uses

“What public policies and institutions are needed for transit-supportive development to occur near transit stations?”

- Data used: Published reports, agency records, interviews, and site visits to six case study cities: Houston, Texas; Washington, D.C.; Portland, Oregon; Vancouver, B.C., Canada; Ottawa-Carleton, Ontario, Canada; and Curitiba, Brazil.
- Main findings: Regions with successful transit-focused development have the following characteristics:
 - Commitment to regional vision of high-capacity transit connections between regional centers or in development corridors,
 - Strong, respected institutions that people trust to deliver

services,

- Political cultures that value transit,
 - High-quality transit service that attracts riders,
 - Regional growth that channels development to station areas,
 - Transit stations located in areas where the market supports development,
 - Regional policies that focus growth in transit corridors and limit it elsewhere,
 - Station-area policies and programs to support private sector investments and transit-friendly development, and
 - Long-term commitment.
- Product: *Public Policy and Transit-Oriented Development: Six International Case Studies* (Volume 2, Part IV of this report)."

(3) Conclusions

"This summary of knowledge and the body of research (new and existing) that supports it provide empirical evidence that transit and urban form relationships are important. The relationships are not as strong as a century ago when new transit investments added significant accessibility benefits and strongly influenced urban development patterns, or when transit disinvestments of 3 decades ago (e.g., replacing streetcar lines with new freeways) added further impetus to automobile-oriented suburban growth. Still, transit and urban form relationships matter because, as demonstrated by the research, there remains considerable elasticity in the relationship — the weight of evidence shows they continue to mutually affect each other.

"Examined separately, each direction of the transit and urban form interaction is significant. To examine the ways in which urban form affects transit patronage, break down the term 'urban form' into several elements. Doing so, it can be seen that the density or compactness of an urban area has the dominant influence on transit use. The relationship between residential densities, employment center densities, and transit patronage is robust. While this relationship is not easily reduced to a single threshold, it operates consistently at many levels of density in many types of neighborhoods, and across many employment centers.

“Within compact urban regions, transit is extremely effective at serving the accessibility needs of CBDs — the dominant employment center in any region. However, in the future, as cities continue to evolve toward multiple centers, transit systems that link the central business district with subregional employment centers will be especially cost effective, offering opportunities for two directional flows at all times of the day. Further, within compact urban regions, transit service in corridors that contain a variety of residential and nonresidential activities will prove especially attractive and competitive.

“The mix of land uses and urban design features in transit corridors also contributes to transit’s attractiveness as a mode of travel. The characteristics of areas around stations strongly influence the way in which patrons travel to and from transit. In employment centers, land use mix clearly contributes to the increasing use of transit, just as in residential neighborhoods, urban design that supports pedestrian clearly influences the mode of access to transit. Though the bundle of attributes that makes for a successful, pedestrian and transit-friendly station area or neighborhood is difficult to break apart through statistical means, the presence of these attributes clearly makes transit a more attractive choice.

“The accessibility advantage which transit can confer on particular locations is capitalized by real estate markets into higher property values and rents. This phenomenon is most evident in cities with extensive rail transit systems. The smaller the system, the more important other factors become in determining the development impacts of transit. A variety of influences must be present, in addition to transit itself, before station-area development or redevelopment will occur. A strong regional vision of a desired urban form, combined with political leadership willing to look at the long-term benefits of a transit investment, is one prerequisite. An efficient, extensive, and well-respected transit agency, working well with other institutions of government, is the second key element. The presence of adequate sites at station areas, and a strong local and regional economy with well-functioning real estate and development, must also be present.

“Lastly, a variety of programs and policies at the regional, local, and station-area levels must be developed and applied creatively. Behind many of these policies is the strategic use of public funds to leverage private investment.

“Public policies can influence the scale, scope, and pace of transit-urban form interactions. Pro-active initiatives by both the public and private sectors can promote meaningful transit and land use interactions and

capitalize on development opportunities as they arise. All of this bodes well for the future of coordinated transit and land use planning and policymaking.

“Although this research examined transit and urban form relationships separately in each direction — these two forces operate dynamically. Transit investments can influence compact, mixed-use, and transit-supportive development. Such development, in turn, can induce transit ridership. This symbiotic relationship is ongoing, with transit and urban form continually reinforcing, reshaping, and helping to reconstitute each other.

“In addition to clarifying the interactive nature of the relationship between transit and land use, this summary of knowledge offers a great deal of information on the specific magnitude of these impacts. As a separate document in this research project, a *Guidebook for Practitioners* (Volume 2, Part III of this report) was produced that contains practical methods resulting from the research summarized in this report. Rather than try to abstract from these findings, readers are referred to the *Guidebook for Practitioners* for a more concise presentation of the quantitative findings behind the many principles listed in this summary.

“Sometimes science can only confirm intuitions. To say that metropolitan areas are large, complex urban systems that are difficult to change comes as no surprise. Thus, to conclude that changes in urban form, or any of its constituent elements, are capable of making enormous changes in metropolitan travel demand would be misleading. Rather, it can be said that strategic changes in local and regional land use policies are capable of influencing transit as much as any other demand management strategy likely to be implemented in metropolitan America. They offer the additional and unique benefit of being long-lasting in their effect. The built environment is durable, and an environment built to support transit for generations of residents to come. While a great deal of metropolitan areas’ urban form is already in place, the fact remains that thousands of individual investment decisions continue to be made every year, every one of which contributes to the evolution of urban form in America. Under a different set of rules and policies governing urban development, a differently built environment

would emerge that would be much more supportive of both existing transit investments and the potential for future ones.

“The researchers conclude that meaningful coordination of transit-urban form relationships must, in the future, take place within a larger systems context. Initiatives to coordinate transit investments and urban development should be framed more globally in terms of such complementary initiatives as travel demand management (TDM) planning, road pricing, regional growth management, and community redevelopment. Transit and urban form always have and always will best complement each other when tied to a larger policy agenda aimed at improving the quality of urban environments. Strengthening future transit and urban form interactions will hinge on recognizing these systematic relationships, and putting in place the package of public programs and private initiatives necessary to accomplish these goals.”

b. Part II: Commuter and Light Rail Transit Corridors: Executive Summary

“The purpose of the research is to provide guidance as to the land use characteristics in a corridor that can support new fixed-guideway transit services cost-effectively. It is postulated that land use characteristics in a corridor are a significant factor that drive the demand for transit service and, therefore, the value and effectiveness of such services. The research supports making the case for fixed-guideway transit where it is cost-effective and conversely lessening the demand for expensive fixed-guideway services where land use characteristics cannot support them. The research also makes it possible to suggest the nature of the changes in land use that could support transit.

“Currently, many metropolitan areas in the nation are considering new rail transit lines. Taken together, if all the proposals were implemented, it would add 2,500 miles of new transit lines and increase the extent such systems by 65 percent. Because most of these proposals are for light rail or commuter rail services, the focus of this research is on those two modes. Twenty-nine metropolitan areas are seriously entertaining new or expanded light rail services and eighteen are considering commuter rail. Heavy rail is only being proposed as expansions in cities where the mode already exists.

“The proposals for additional rail transit are being advanced despite the long term and continued trend away from the core of our metropolitan areas and toward suburban development that tends to work against transit. The attention to new transit lines is motivated by a number of factors including:

- Concerns about the negative impact of auto-oriented sprawl;
- Desires to reduce air pollution and energy consumption;
- Interest in rebuilding urban communities;
- Need to provide access and mobility to those without autos; and the
- Desire to save the costs and avoid the impacts of constructing new or widened roads.”

(1) Approaches to Demand and Cost Modeling

“The approach taken in this research is to first define, as a function of land use in a corridor, the likely light rail or commuter rail ridership generated in that corridor. Once these ridership levels are determined they are matched against the costs — both operating and capital — necessary to meet the demands for the service. A series of hypothetical but realistic corridors are constructed, with varying land use patterns and intensities, and then light rail and commuter rail lines are overlaid on the corridors to determine the ridership and costs generated by the relationships developed in this research.

“The analysis focused solely on radial corridors emanating from the Central Business Districts (CBD), since they are the only corridors that exist today. It is not possible to develop demand relationships for non-radial corridors in the absence of such data.

“On the demand side, a generic model is developed to account for the major factors that generate transit travel in a corridor, including land use, its intensity, and location. Two models, one that estimates daily ridership boarding at a light rail station and the other at a commuter rail station are developed. Data from 19 lines in 11 metropolitan areas with a total of 261 stations are used for the light rail model. Data from 47 lines in six metropolitan areas with a total of 550 stations are used for the commuter rail model. The models bypass the usual four-step travel demand modeling process with a simplified approach that estimates transit demand directly, incorporating trip generation, mode choice, trip distribution, and trip assignment features. The models consider the number of people living near the station, the characteristic of that population such as income and auto ownership, the size and density of unemployment in the CBD which the line serves, the distance and travel time between the station and the CBD, the availability of access mode services such as feeder bus and parking, and the

impact of competing rail services nearby, either on the same line or on parallel ones.

“The results are two demand models, one for each mode that account for most, but not all, of the postulated factors. Table ES-1 summarizes the results. As expected population density near the station matters for both models, but because of collinearity problems, only employment density and not employment size could be included in the commuter rail model. Income shows up in the commuter rail equation, with higher incomes producing more trips for this relatively expensive model. Access mode availability shows a strong effect for both models, with feeder bus availability more important for light rail and parking availability more important for commuter rail. The distance of the CBD also is an important variable with light rail riders dwindling farther from the core, but for commuter rail the distance function is more complicated, first growing with distance and then dropping beyond about 35 miles. Competing service entered the picture in the light rail equation where the competition from a nearby station on the same line dampened ridership.

“The cost models are developed from data from twelve light rail and eleven commuter rail systems and identify the factors that contribute to operating and capital costs. Operating costs are largely a function of labor requirements, which are, in turn, a function of the extent of the system, how intensively it is used and indirectly, and the ridership on the line which drives the size of the vehicle fleet that must be maintained. In the relationships, annual vehicle-hours, annual vehicle-miles, the size of the vehicle fleet, and track-miles figure prominently in the operating cost relationships for both modes. Capital costs were developed using contract costs. As expected, the operating costs show a stronger relationship with the use of the system and the capital costs show a stronger one with the extent of the system. Taken together, the costs are indirectly a function of ridership, and thus, indirectly a function of land use.

“It is also helpful to define the range of peak hour riders for which each of these two rail modes would logically operate. The physical characteristics of a line put an upper limit on ridership levels. For light rail this translates into daily one-way boardings of 46,000. For commuter rails its 80,000. Similarly, below some ridership level the amount of peak hour service that could be offered is too low to be a reasonably attractive service. For light rail this translates into 2,700 daily one-way boardings; for commuter rail it is 3,600.”

Table ES-1. Summary of Factors Influencing Light Rail and Commuter Rail Ridership

<u>Variable</u>	<u>Light Rail</u>	<u>Commuter Rail</u>
Employment	CBD jobs CBD job density CBD jobs & job density	CBD jobs CBD job density CBD jobs & job density
Population	density within 2 miles density within 1/2 mile	density within 2 miles density within 1/2 mile
Access	some feeder bus parking available	some feeder bus parking available
Distance to CBD	log linear quadratic	log linear quadratic
Competition	nearest station nearby line	nearest station nearby line
Income	income	income
Terminal?	yes	yes
CBD Terminal Distance	not applicable	no

“The table lists all factors that were considered in the analysis. **Bold** type indicates the variables that are statistically significant in the best-fitting models.

“An analysis of hypothetical light rail lines show that there is a significant range of conditions for large cities where light rail systems are likely to be inappropriate, particularly where CBD jobs are in excess of 250,000. In these larger CBDs ridership would exceed manageable levels. At the low end of the light rail ridership spectrum, even CBDs of only 25,000 jobs can support the service ridership grounds.”

(2) Findings

“With the demand and cost models in hand, a series of hypothetical corridors are constructed to estimate the travel demand for them, and then the costs. For these corridors CBD employment and density, residential density gradients in the corridors, access mode availability, and rail line length are varied. For each of these corridors the number of

riders that would board trains on an average weekday are estimated.”

(a) Light Rail Ridership Grows with CBD Size and Density and with Residential Density

“For light rail corridors the most striking feature is the exponential growth that occurs as both CBD employment and employment density increases. Higher ridership levels also occur with higher residential density gradients with the most substantial increases occurring with longer lines. With an increased length, ridership grows, but on a diminishing per mile basis. The availability of feeder buses impacts ridership significantly too. When this service is provided to virtually all of the stations, ridership grows by about 15 percent compared to a situation where only about half the stations have feeder bus available. Parking availability has a much weaker effect on light rail ridership.”

(b) Commuter Rail Service Requires Dense CBDs but can Operate in Low Density Residential Areas

“Commuter rail ridership also grows significantly with CBD size, but does not grow in the same exponential fashion as light rail. CBD employment density also has a lesser effect that it does for light rail. Residential density appears to have little effect on commuter rail ridership because of growing ridership with distance to the CBD (up to about 35 miles) even as residential density falls, and because of the offsetting effects of income. (Higher incomes associated with lower densities produce more, not less riders.) The net effect that for commuter rail, unlike light rail, residential density in the area of the stations is largely irrelevant to ridership. Only in the limited situations where higher densities are associated with higher incomes within reasonable commuting distance by commuter rail -- say 40 miles -- will the positive impact of higher residential density on commuter rail be felt. For commuter rail the roles of the two access modes are reversed. Parking availability has a larger impact than does feeder buses.

“These findings suggest that low density areas can support commuter rail ridership by bringing riders from a large area, especially if parking and some feeder bus service is provided to offset the small numbers within waling distances to stations. Of course, site specific situations and cost may not always make it possible or desirable to provide parking and bus feeders at all stations.

(c) Light Rail Costs Rise with Ridership and Line Length. Commuter Rail Costs Vary with CBD Size and Line Length.

“Turning to cost consideration it is hardly surprising that light rail costs the most when the ridership is high and the line is long. Higher CBD employment drives the growth in ridership, which, in turn, requires more vehicles and more workers to operate and maintain them, increasing operating costs. The line length, meanwhile adds to the operating cost too, with more riders and with more workers needed to maintain the right-of-way. Similarly, the higher ridership associated with higher residential densities also drives up costs.

“For commuter rail, operating costs are high when the CBD is large and the line is long, but capital costs are less sensitive to CBD employment and more sensitive to the length of the line.

“While there is value in understanding the factors that separately affect both operating and capital costs -- the funding sources are usually different -- in this analysis the two are combined by added the annual amount necessary to replace the capital to the operating costs. This is referred to as the total cost.

“The analysis of hypothetical commuter rail lines suggest that commuter rail, at least from a ridership perspective, requires large CBDs and relatively long lines. It remains to be seen what happens when cost criteria are added to the mix.

(d) Light Rail Works Best in Larger Cities with
Denser
Corridors. Commuter Rail Works Best
with Dense CBDs.

“Measures of cost-efficiency and effectiveness are next calculated for the hypothetical light rail lines. Cost-efficiency is measured by total cost (annual operating cost plus depreciation) divided by the annual-vehicle miles. Effectiveness is measured by daily passenger-miles per line-mile.

“Collectively, for light rail the measures of cost-efficiency and effectiveness each indicate a strong positive relationship with CBD employment size and residential density. A weaker but significant relationship also occurs for CBD employment density and for line length. This suggests that larger cities with higher density corridors will work best for light rail. But as noted earlier at very high demand levels for larger CBDs, the ridership attracted to light rail may not be practically handled and a higher capacity heavy rail may be needed. At the lower end of the land use spectrum, cost-efficiency and effectiveness may suffer, but increases in residential density might make up for smaller CBDs, and conversely more development in the CBD could allow for effective and

efficient light rail without any significant increase in residential densities. The importance of both the size and density of CBDs suggest that corridors that do not pass through or terminate in a CBD would be harder pressed to be cost-effective.

“Within the range of feasible commuter rail corridors much more travel will be accommodated on lines to larger and more dense CBDs. But there is a cost-efficiency trade-off. The larger and more dense CBDs will cost more on a per vehicle-mile basis. That can be mitigated by making the line longer. But that too involves a trade-off, since longer lines will cost more to construct.

“The analysis describe in this report, summarized in Table ES-2, suggests strongly that light rail and commuter rail transit performs better when there is a large CBD. However, light may not work at all when CBDs get too large since ridership may outstrip the modes carrying capacity. For commuter rail, the larger CBDs produce more effective services, but are slightly less cost-efficient.

“The density of the CBD is particularly important for commuter rail, probably because there is usually only one terminal station and lower density CBDs may put some jobs beyond easy reach of the terminal station. Light rail, in contrast, is less affected by the density of the CBD since there are likely to be multiple stations to serve lower density CBDs.

“Residential density itself matters for light rail and commuter rail but, in the latter case, density is confounded by the effect of income, since commuter rail’s higher fares attracts more riders with higher incomes, who also tend to live at lower densities.

“The length of the rail line assumes some importance for both light rail and commuter rail. Longer light rail lines are both slightly more cost-efficient and effective. But the effects diminish with length. Commuter rail lines are much more cost-efficient when they are longer, but their effectiveness declines beyond 50 miles. At short distances there often are not enough riders to justify even minimal service on commuter rail.

“The availability of access modes can help to achieve higher performance levels, all else being equal; feeder buses more strongly affects light rail and parking more strongly affects commuter rail.

(e) Light Rail and Commuter Rail Serve Different Markets

“Among the more interesting findings in this research is the distinctly

different characteristics of light and commuter rail. It is clear that they serve different markets and different land uses patterns. Indeed, there are more dissimilarities than similarities. This does not imply that in any one metropolitan area they both may not have a niche, only that they have different niches.”

Table ES-2. Summary of Findings on Cost Efficiency and Effectiveness for Hypothetical Rail Corridors

Factor	Cost Efficiency (total cost/vehicle mile)	Effectiveness (passenger miles/lane miles)
Light Rail		
Residential density gradient	highly positive	highly positive
CBD employment numbers	moderately negative at high CBD job levels rail may not be feasible	highly positive
CBD employment density	slightly positive	moderately positive greater impact for larger CBDs
Feeder Bus	unclear	highly positive
Parking availability	unclear (site specific)	moderately positive
Line length	slightly positive	slightly positive
Commuter Rail		
Residential density gradient	not significant	not significant
CBD employment numbers	slightly negative, for smaller CBDs may have insufficient riders, especially for shorter line lengths	highly positive
CBD employment density	highly positive	highly positive
Feeder Bus	unclear	moderately positive

Parking availability	unclear (site-specific)	highly positive
Line length	strongly positive, insufficient riders for shorter lengths	varies, best at 50-mile length

(3) Other Considerations for Evaluating Specific Proposals

“Not accounted for here but worthy of serious exploration is a fuller consideration of costs, including those saved as a result of other modes not used, if the rail line is put in place. To accomplish this it would be desirable to assign the rail ridership to the modes from which riders would be diverted — auto and bus — and estimate the appropriate savings in operating, capital and full environmental costs. Beyond that, the application of the full cost of both transit and highway modes can balance the burden that rail transit must now bear in proving its value. Also, not accounted for is the sizable ridership that might be found traveling to nonresidential clusters at intermediate stops or at the non-CBD terminal. In a number of places, particularly for light rail lines this has proved substantial. The relationships in this report can be applied in such situations.

“The need of planners to have specific land use thresholds for support of transit is understood. In fact, the earlier works by Pushkarev and his colleagues provided such thresholds. But these works were also clear to caution the reader that such thresholds were no substitute for careful sit-specific analysis. The thresholds were only a guide to give planners a sense of whether there is a reasonable possibility for transit to work in different settings. Such a guide is still needed today, and the earlier works can still serve that purpose, but now with the added caveat created by the passage of some 15 to 20 years. In this report, land use specific thresholds are not given. Rather, further guidance of the expected effectiveness and efficiency of fixed rail systems as a function of land use is provided to help put ‘meat on the bones’ to assist in the consideration of so many plans now being put forth.

“Finally, this effort should not be viewed as a substitute for a careful examination of all transportation alternatives in all types of corridors including those that do not end in the CBD, accounting for site-specific conditions and preferences. Rather, it should be seen as a means to understand the role that uses in a corridor play in determining costs. Further, it makes clear the need to integrate transit planning with land use planning at the earliest possible stage, a finding that is reinforced in the case studies prepared for another report of this project, Public Policy and Transit Oriented Development: Six International Case Studies.”

32. Transit and Urban Form — Volume 2

(Parsons Brinkerhoff Quade and Douglas, 1996)

This volume contains two parts: Part III (A Guidebook for Practitioners) and Part IV (Public Policy and Transit-Oriented Development Case Studies). Part III discusses basic relationships between urban form and public transportation, the role of transit in regional planning, the role of transit in corridor planning, and station area planning and development. Part IV includes case studies from Houston; Washington, DC; Portland, Oregon; Vancouver, B.C.; Ottawa-Carleton, and Curitiba, Brazil.

“As the 20th century nears an end, land use and transportation planners and decision makers are reexamining the relationship between transportation and urban form while keeping the following issues in mind:

- Rapidly growing metropolitan areas, faced with increasing traffic congestion and environmental degradation, are trying to manage growth so as to reduce automobile dependence and preserve open spaces and agricultural lands.
- Suburban activity centers, developed around convenient automobile access, are reaching levels of development and employment densities similar to many downtowns. Planners and decision makers are trying to integrate transit service and pedestrian improvements into these automobile-oriented areas.
- More and more suburban communities are turning to ‘neo-traditional’ planning concepts to help restore pedestrian life and a sense of community to automobile oriented, residential areas.
- Older cities, many of which were built up around transit lines, are losing population and employment to suburban areas. As suburbs develop and automobile ownership rates increase, transit ridership declines and costs per rider increase. This situation leads to a discouraging cycle of higher fares, service cuts, further ridership

declines, and station closings. Reduction in accessibility and service quality accelerates the economic decline of city neighborhoods and business districts. Planners are thus seeking ways that transit investments and transit-related development can be used to help revitalize downtowns and rebuild neighborhoods.

“The common factor in these situations is the search for patterns of development that encourage alternatives to the automobile for work- and non-work-related travel.”

“Long-range integration of transit and land use depends on regional and local land use planning and transit agencies coordinating their efforts more closely than has been the case in most U.S. cities. This coordination involves establishing multidisciplinary functions within agencies (i.e., using transit planners as staff at regional land use planning agencies and having land use personnel or developers as staff at transit agencies) or creating agencies with a joint mission to plan and develop transit and associated development.

“The case studies investigated for this research yielded several interesting approaches to planning and implementation; these are discussed in the following paragraphs.

“Since its inception, Washington’s Metropolitan Area Transit Authority (WMATA) has had a strong joint development-land use department, with a mission that includes station area development and land use planning. WMATA works with local jurisdictions to foster appropriate station area development. In some cases, WMATA issues RFPs to developers; in others, counties take the lead in developing station area planning and design guidelines and implementing station area master plans. Several local jurisdictions have adopted transit-oriented planning as a primary tenet of their planning for community development. . . .

“Non-profit groups can advocate integrated planning. The 1000 Friends of Oregon, the Washington Regional Network for Livable Communities, and the Surface Transportation Policy Project (STPP) have raised public awareness of how land use management can shape urban form and reduce traffic congestion and how transit can shape urban form and reduce sprawl. The STPP has incorporated this awareness into guidelines for federal funding through ISTEA. Such groups also facilitate the public participation necessary to achieve agreement on plans and investment decisions.

“Strong, long-term leadership is critical to achieving consensus on a regional vision. Efforts in Houston, Portland, and Curitiba were all led by

charismatic individuals who gained sustained, widespread support for their transit-land use visions.

“Experience in California and elsewhere has shown the importance of having a local politician support transit-oriented development, a transit agency that is willing to use features such as parking lots to allow station-linked development, risk-sharing by the public agencies (e.g., free land leases in return for a share of development profits or loan subordination) and the power of a redevelopment authority to condemn and assemble land and to use tax increment financing.”

33. Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas

(Smith, et al., 1987: Summary)

“The research brought to light many facts and observations regarding both problems with pedestrian facilities as well as creative ways which have been employed by the public and private sectors to solve those problems. The general topics addressed are pedestrian travel behavior and accident characteristics, commonly occurring problems with suburban pedestrian facilities, pedestrian planning within the context of the overall planning and development process, pedestrian-sensitive site planning, planning for pedestrian facilities within the highway right-of-way, and implementation of pedestrian facilities.

“One of the overall conclusions from the research is that pedestrian planning cannot be conducted in isolation from other planning elements (i.e., land use and highway design). Rather, planning for the pedestrian must be integrated with the entire process of planning, design, and implementation by the public and private sectors and effectively advocated within that process.

“Pedestrian planning, design, and implementation is a joint responsibility of the public and private sectors. The general flow of the pedestrian planning, design, and implementation process is illustrated in the following diagram. This includes an initial stage in which problems are identified and conditions documented. In this report, the emphasis is on the problems of pedestrian convenience and safety. Subarea planning activities are undertaken for areas of special concern or emphasis. Pedestrian planning is an integral part of both these levels. This is followed by a still more detailed level of site planning — the planning and design of pedestrian networks in conjunction with private land development. Pedestrian planning and design within the highway right-of-way is usually a public responsibility. Implementation is the critical step in making the planned and designed facilities a reality. Institutional issues

which inhibit effective pedestrian planning must be addressed head-on if real progress is to be made.”

a. Why is Planning for the Pedestrian Important?

“Most people would acknowledge that planning for the pedestrian is necessary in downtown high-density settings. After all, that is where pedestrians are. Certainly, great strides have been made in the planning and design of pedestrian spaces in the downtown, and this emphasis needs to be maintained. But people walk in the suburbs too. Worn footpaths along major highways attest to the fact that pedestrians are there. In some suburban land-use settings they are present in great numbers. Although pedestrian needs cannot be expected to dominate in the consideration of the many suburban transportation and land-use priorities, they need to be thought about in a deliberate, systematic way. The following paragraphs state some of the reasons why it is in the public interest that the pedestrian be an integral part of the planning, design, and implementation process in suburban as well as in downtown areas.

“Compact, pedestrian-oriented land-use arrangements make pedestrian travel easier and eliminate some vehicular travel. Although this will not solve the congestion problem, it is a start, and encourages the conservation of energy resources, reduces development costs, reduces public infrastructure requirements and costs, and is more easily served by transit.

“Pedestrian-sensitive site planning and design also makes a development more marketable. Planning for the pedestrian and for associated amenities pays off in the long run. Several instances of this were noted in the case studies.

“Pedestrian safety remains a national problem. Between 7,000 and 8,000 pedestrians are killed annually and more than 100,000 are injured. Tort liability claims are also steadily increasing. Planning itself and the agencies that conduct planning activities become more credible when an integrated transportation system is achieved. While drivers may not notice the pedestrian elements as much as the pedestrians do, comprehensive planning for all modes instills the public’s confidence and makes the job of planning easier.

“On-going pedestrian planning and facility maintenance can remove public eyesores and solve spot problems that are the source of citizen complaints or of real safety hazards.

“The continued public interest in fitness, recreation, and outdoor exercise

calls for well-located and designed recreational walking, jogging, and biking facilities.

“Accessibility for all groups continues to be a national objective. The young, the elderly, the visually impaired, the nonambulatory and other less agile individuals present special design considerations. Some of the most glaring deficiencies are in suburban and developing rural areas.”

b. Pedestrian-Related Problems in Suburban and Developing Rural Areas

“This study identified problems experienced by pedestrians in suburban and developing rural areas as well as potential solutions to those problems. Typical problems addressed include: (1) difficulty of crossing wide, heavily trafficked arterial and collector streets; (2) lack of walkway or other designated walking area along major highways; (3) insufficient lighting at intersections and along highways; (4) indirect or circuitous pathways between pedestrian magnets; (5) security problems on some secluded sections of pathway; (6) difficulty of justifying overpasses and underpasses, and many existing overpasses not well utilized; (7) auto orientation of the suburbs, due to low-density land-use patterns that typically exist; (8) pedestrian system remains incomplete because construction of sidewalks traditionally awaits development or redevelopment of land parcels, and where public agency does not step in, missing links perpetuate; (9) developing pressure, as time goes on, to increase land-use intensity, and locations where pedestrian facilities not originally viewed to be needed gradually generate the need as redevelopment and infill development occurs; (10) general lack of respect for pedestrians by drivers, at least partially brought about by lack of enforcement of laws governing pedestrian right-of-way; (11) overlooking of pedestrian needs by planners and engineers in site planning, highway design, and development review; (12) inflexibility of zoning ordinances, subdivision regulations, and other local codes to allow unique designs that would favor the pedestrian.

“Implementation problems were acknowledged to be some of the most serious problems facing pedestrian mobility and safety in the suburbs. Many of the problems observed by the research staff were simply planning and design oversights or victims of an inflexibly planning process. The pedestrian is often excluded as a design consideration in development projects and in suburban highway design, and becomes merely an afterthought.”

c. The Pedestrian Planning Process

“One of the conclusions of the study was that the process of planning pedestrian facilities must be fully integrated into the other ongoing planning activities (e.g., comprehensive planning, subarea planning, and site plan review — principles and procedures for each of these areas are provided in the report). A completely separate planning process for the pedestrian is not needed and will be counterproductive. Research into local and state planning processes revealed several key elements that appeared to be consistently present in jurisdictions that were adequately treating pedestrian accommodations in their planning process. These elements comprised: (1) policy statements in the comprehensive plan that relate to pedestrian needs and objectives; (2) inclusion of pedestrian facility elements (especially a master plan of walkways) in the comprehensive plan; (3) preparation of subarea or sector plans for areas needing special coordination; and (4) designation of a knowledgeable person or persons on the planning and / or engineering staff to serve as the in-house pedestrian advocate.

“Effective pedestrian-oriented land-use planning will have the most significant impact on pedestrian travel of any pedestrian strategy. Compact, higher density land use is recommended where environmentally compatible with surrounding uses. The ‘urban village concept’ is set forth as a desirable development form in which access to the area may be predominately by auto, but circulation within the area would be largely on foot.”

d. Pedestrian-Sensitive Site Planning

“Substantial attention was given in this project to principles and procedures for pedestrian-sensitive site planning on private development sites. The principles were based on findings from the case studies, the literature, and experience of the research team. Eight land-use types were covered, including: residential developments, shopping centers, office and industrial parks, mixed use development, commercial strip development, suburban activity centers (new and redeveloping), main streets in small towns and older suburban areas, and freestanding single use sites.

“The report presents findings from the research in each of the foregoing areas, as well as a set of planning and design principles applicable to each site type. Procedural steps for planning a walkway system were also developed, and implementation issues were addressed for each use.”

e. Pedestrian Planning Within the Highway Right-of-Way

“The crossing of heavily trafficked arterial streets is widely regarded by users as one of the most significant pedestrian problems in suburban areas, if not the most significant problem. Areas investigated in this research included highway cross section design, design of intersections and interchanges, and other related elements.

“The importance of medians to the convenience of pedestrian travel in suburban and developing rural areas is one of the most significant findings of this study. When traffic signals are infrequent, as they are on many miles of suburban highway, ways need to be found to make it easier for pedestrians to cross these high-volume arterials, while maintaining traffic flow. Medians or strategically placed refuge islands make a dramatic difference in facilitating the pedestrian’s task of crossing the street. Islands for pedestrian refuge should be considered much more frequently than they currently are. European countries make considerably better use of refuge islands than has the United States.

“Two other significant observations are: (1) There should be more emphasis on requiring walkways or shoulders on arterial and collector streets. Some subdivision regulations are more specific than others in requiring these adequate walking areas. The State of Florida now requires at least a 4-ft paved shoulder on highways within 5 miles of urban areas to accommodate pedestrians and bicyclists. (2) sidewalk flares (extensions of the sidewalk into the parking lane) have potential for wider application as a benefit to pedestrians, with minimal impact on vehicles.”

f. Implementation

“Implementation represents those actions taken by public agencies, the community, or the private sector to bring pedestrian facilities into being. Information collected in this project pointed toward a number of implementation-related actions that can be taken by each of these groups to foster the provision of effective suburban pedestrian systems.

“The most significant of the implementation strategies is simply states: **THINK PEDESTRIAN**. There are so many other necessary details to be covered in a development project or transportation plan that it is not uncommon to simply forget about the pedestrian in the shuffle. *Think Pedestrian* means including the pedestrian as a factor in site planning, highway design and operations not as an afterthought, but at each stage of the planning, design, and implementation process from beginning to end. This need not take a great deal of time or expense. Most of the pedestrian considerations can be treated easily and simply. But

observations in this project suggest that pedestrians are often left out of the process until the last minute, when it may be too late to influence site designs or planning strategies. Obviously this is not always the case, but simple remembering to think about the pedestrian will solve many of the oversights that occur.

“Some of the tools investigated in this research that can be applied to the implementation of pedestrian facilities include zoning ordinance provisions; subdivision regulations; flexibility and discretion within the site plan review process; advocates for the pedestrian, both within the public agencies and within the community; obtaining easements for pedestrian facilities; financing pedestrian facilities through capital budgeting, revolving funds, special assessment districts, and other techniques; maintenance management; and changes in state to encourage the provision of pedestrian facilities.

“The case studies provided a wealth of material on which to draw experience and principles that can be applied to other situations. Lessons learned from both the physical design and implementation elements are documented to provide examples of both effective and ineffective strategies.

“It is instructive to remember that *everyone is a pedestrian sometime*. We all benefit from the implementation of pedestrian facilities. Greater attention to the needs of pedestrians in the planning and implementation stage is the key to creating suburban environments more conducive to pedestrian travel.”

34. Relationships Between Land Use and Travel Behavior in the Puget Sound Region

(Frank and Pivo, 1994b: Summary)

“Our overall finding is that certain land-use patterns, including greater employment density, population density, land-use mix and job-housing balance, are associated with less auto use. This occurs even when other factors that affect travel behavior are controlled, such as household demographics, car ownership, and transit level of service. Our findings reinforce previous results in the scientific literature but are derived from data on the Central Puget Sound, giving them more validity for Washington State than previous studies.

“One way that land-use can lessen auto use is by reducing the proportion of trips that are made by single occupant vehicles (SOVs). This effect occurs after density thresholds of 50-75 employees per gross acre or 9-13 persons per gross acre (about 9 to 12 dwelling units pre net acre) are

crossed. These thresholds are 6.5 to 10 times the average employment density and 2 to 3 times the average population density presently found in Central Puget Sound census tracts. To reach these thresholds, it would be necessary to develop urban and suburban centers similar to those proposed by the City of Seattle in *Toward A Sustainable Seattle* and already adopted by the Puget Sound Regional Council in *Vision 2020* and the King County Council in *Countywide Planning Policies*.

“Downtown Bellevue and Pioneer Square in Seattle are examples of tracts with employment densities of 50 employees per gross acre. They have similar gross densities but very different built forms. Downtown Bellevue combines high-rise office towers fronting on plazas with one and two story retail and surface parking. Pioneer Square is predominantly four and five story buildings covering all of their parcel and containing offices over retail.

“Examples of census tracts with population densities of 11 persons per gross acre are Seattle’s Northgate area, Benson Center on Kent, and northern Everett along Broadway. These areas vary in character and include housing types ranging from detached single family homes on 3,600 to 9,000 square feet to multi-family housing in garden apartments and low-rise apartment blocks.

“It is not necessary for centers to contain both jobs and housing to reduce auto use. Combinations of dense housing, shopping, and dense employment are associated with the greatest reduction in auto use; however, reduced auto use can also be expected in relatively pure but dense employment areas, in areas that combine dense population with less dense employment or shopping, and in areas that combine dense employment with less dense housing or shopping.

“Another way that land-use can reduce SOV use is by shortening trip distances. Shorter distances are found in tracts with greater land-use mixing, job-housing balance, population density, and employment density. A mix/balance approach could reduce trip distances without increasing densities, and could reduce miles traveled comparable to that generated by a density/centers approach. Examples of balanced census tracts include Seattle’s Fremont area, Renton’s Talbot Hill area southeast of the I-405 and Valley Freeway intersection, and parts of the City of Kirkland. Highly mixed tracts include Federal Way’s Steel Lake area, parts of Bellevue, and Seattle’s Northgate and its environs.

“Greater density, land-use mixing, and jobs/housing balance are associated with less auto use for work and shopping trips. In particular:

- greater density is associated with reduced trip distance and a lower proportion of trips made by single occupant vehicles (SOVs);
- greater land-use mixing is associated with reduced trip distance and travel time; and
- greater jobs/housing balance is associated with reduced trip distance and travel time.

“This study confirms the finding of previous researchers that the relationship between density and mode split is nonlinear. At the lower end of the density spectrum, a given change in density is associated with less change in SOV use than the same density change at the higher end of the spectrum. Significant movement from SOVs to other modes does not occur until certain density thresholds are reached. For work trips, the thresholds are 50 to 75 employees per gross acre or 9 to 13 residents per gross acre (about 12 dwelling units per net acre). For shopping trips, they are 75 employees per gross acre and 18 residents per gross acre (about 20 dwellings per net acre).

“Several factors other than land-use affect individual travel behavior. They include age, possession of a driver’s license, access to a car, working at home, transit level of service, and household type. Controlling for these other factors does not significantly diminish the effect of land-use.”

35. Transportation and Economic Development (Transportation Research Board, 1990)

“Transportation is a vital element in local, regional, and national economic development. Transportation provides access to land and communication. Although there are many factors that determine whether specific lands will be developed, the ultimate foundation of any development is transportation. Transportation facilities provide the means for transporting raw materials to manufacturers and finished products to markets. They provide personal conveyance and communication and movement of the many service functions necessary within a society. That transportation is a vital element of any society has never been in question.

“The primary difficulty for transportation planners is isolating the economic consequences of transportation investments and comparing them with the

consequences of all other public and private investments. Another major problem is to establish causative relationships between specific transportation investments and subsequent economic events.

“The impacts of introducing transportation where there was no previous access are relatively easy to establish. The impacts of marginal increases or decreases in transportation services are difficult to measure at the project, regional, or national level, because there are so many other factors simultaneously at work that affect economic development.

“The United States is faced with an ever-increasing demand for use of transportation services. The transportation infrastructure is wearing out faster than it can be replaced or new facilities can be constructed. Those responsible for transportation development are concerned that the public is not aware of transportation needs or the effects of resources that are insufficient to maintain existing services or respond to increasing demand. They are, therefore, looking for a way to clearly establish a causative relationship between transportation and subsequent economic development. Transportation developers hope that establishing such a relationship will persuade the public and government decision makers to provide funds for maintaining and upgrading the transportation infrastructure.

“The papers in this Record are the proceedings of an international conference on transportation and economic development that was held in Williamsburg, Virginia, in November 1989. The conference examined the interrelationships between investments in all modes of transportation and economic development. The conference examined the impacts of transportation on productivity and economic factors that improve the well-being of the community or region. The primary focus of the conference was on evaluating methods and modeling techniques and on examining economic impacts of modal transportation investments through a series of case studies.

“The papers presented in the Record concern the following issues: (a) economic impact methodologies, (b) modeling impacts of transportation investments, (c) economic impacts of modal investments, (d) rural and agricultural impacts of transportation investments, (e) case studies of modal investment impacts, and (f) planning issues in transportation investments for economic enhancement. An overview of the methodology and a conference summary conclude these proceedings.”

a. Role of Transportation in Manufacturers' Satisfaction with Locations

"A study is currently under way in North Carolina to examine the complex relationship between transportation investments and satisfaction of manufacturing firms with location. The study is part of a continuing analysis by the University of North Carolina at Charlotte to develop the linkage between transportation and economic development. The 100 counties of North Carolina were classified according to transportation to transportation access, economic structure, manufacturing composition, and socioeconomic characteristics. A data set consisting of more than 400 variables was analyzed using factor analysis and cluster analysis to develop the classifications. The counties were then grouped into six clusters. Using this cluster structure, a survey of about 1,000 manufacturing firms in North Carolina is being conducted using an extensive mail questionnaire. Manufacturers have been asked to describe their perceptions of the importance of transportation systems and other factors in bringing in materials, shipping out products, and providing access to labor markets. These data will be correlated with information on highway investments, location of the firm with respect to the highway system, and other transportation access measures. Models such as factor analysis, discriminant analysis, and canonical modeling will be used to determine the relative importance of transportation against other socioeconomic and fiscal variables in determining manufacturer satisfaction. Then, policy analysis of various transportation funding strategies will be used to determine the effects of investment. Findings will be used to help rank transportation system investments intended to strengthen the state's industrial base."

b. Methodology for Assessing Local Land Use Impacts of Highways

A methodology to project and evaluate the potential land use impacts of a proposed limited-access highway extension in the Rochester, New York, metropolitan area is described. The analysis, the result of a 1-year consultant study for the New York State Urban Development Corporation and local sponsors, examined the potential impacts of linking the towns of Brockport and Albion, west of Rochester, to the Rochester central business district (CBD) via an extension of Route 531. An important constraint that affected the selection of assessment methodologies was the relatively modest amount of time and resources available for the study. This type of resource constraint, which was probably the norm for planning studies, precluded the development of a grand land use/transportation modeling effort in the style of the National Bureau of Economic Research Study, Puget Sound, or Bay Area Simulation

pioneered several decades earlier. It required instead the use of methodologies or models that would not require enormous amounts of data, time, or effort to calibrate. The approach used to project potential residential location decisions was to develop a gravity model of residential location. In general, gravity models, when applied to residential location, require calibration of accessibility index scores for subareas that are then used to reallocate a region-wide growth projection to the subareas. The key advantage of this approach was that it was sensitive to changes in travel times between residential zones and major employment nodes. A qualitative approach was used to evaluate business impacts. The basic methodology involved a review of the competitive advantages of the area with and without the highway extension that included surveys of businesses inside and outside the Brockport-Albion corridor. A separate region-wide marketing analysis was performed to assess retail development possibilities in the Brockport-Albion corridor.”

c. Economic Impacts of Transit on Cities

“Justifications for transit investments have included stimulating community revitalization, creating jobs, spurring economic development along a specific transit corridor, and maintaining and sustaining dense urban centers that are becoming paralyzed by automobile congestion. However, opponents of transit investments argue that the actual economic effects of transit do not meet these claims and do not warrant the expenditure of public funds. Transit studies have provided mixed evidence of whether or not the objectives are actually met by transit. A review of the transit literature was conducted to examine the existing economic impact reports for rapid transit systems in the United States and Canada. Sample cities were chosen for case studies to test the varying opinions of policy makers, planners, business people, and developers on the objectives of transit investments and to determine the extent the objectives were achieved in each city. Four types of cities were sampled: older, established rail cities (Boston, Massachusetts); newer rail cities (Atlanta, Georgia); newer cities proposing rail transit (Dallas, Texas); and smaller, bus-oriented cities (Hartford, Connecticut). For each city, the transit system’s characteristics, goals, and objectives, and impact on economic development were discussed. Findings indicate that transit assists other factors in creating and directing new development projects, provides crucial access into highly congested downtowns, contributes to quality of life that makes a city more attractive for economic development, and provides economic opportunity for transit-dependent populations in urban areas.”

*d. Framework for Analyzing the Impacts of Fixed-Guideway
Transit Projects on Land Use and Urban Development*

“An approach is presented for predicting the impacts of fixed-guideway transit projects on land use and economic development. The Urban Mass Transit Administration developed this approach to help local agencies perform transit project planning studies, including alternatives analyses. The relationships between land use and transportation are reviewed and technical methods for identifying land use impacts at the regional, corridor, and station area levels are described. The importance of supportive land use policies and ways to evaluate the desirability of anticipated land use impacts are identified.”

**36. Interstate Highway System: Reshaping the Nonurban Areas
of Pennsylvania**

(Eyerly, Twark, and Downing, 1987: Abstract)

“In this study are described the economic changes that occurred from 1970 to 1980 in communities adjacent to selected non-urban interchanges on the Interstate highway system of Pennsylvania. These changes are compared with those in the counties in which the interchanges are located and in the state as a whole. Indices of economic growth, both conventional (i.e, housing, income, employment, population) and new (assessed market value of real property), are used. Changes in per capita income at the county level were found to be positively related to the existence of nonurban interchanges in the county. The economies of many nonurban communities near the Interstate system are continuing to be reshaped with larger increases in residential, commercial, and industrial growth.”

**37. Interstate Highway Interchanges as Instigators of
Nonmetropolitan
Development**

(Moon, 1987: Abstract)

“Although the Interstate highway system of the United States is the subject of much varied and detailed investigation, much of the inquiry performed to date suffers an inexplicable urban bias. This study focuses on the nonurban impact of the nation’s premier transportation network by examining 65 non-metropolitan interchanges in Kentucky. Six interchanges are identified as ‘interchange villages’ that actually function as central places in their respective regions. Three of this sub-group that are stereotypical are analyzed as examples of the different functions that they perform. These newly formed towns serve as island communities of other urban places, tourism-driven service centers, or focus points of

entire regions. The cyclic pattern of evolution that nonmetropolitan interchanges can be expected to follow is presented as well as a discussion of what might be in store for these previously remote and isolated interchange sites. This project fills a void in the literature because it provides an in-depth nonurban analysis based on a significantly large number of observations.”

38. Parking Restrictions in Employment Centers

(Hamerslag, Fricker, and Van Beek, 1995: Abstract)

“Measures designed to discourage automobile use and encourage use of alternative modes need to be carefully evaluated to avoid unintended consequences. The impact of a particular set of protransit parking policies on mode and destination choice was examined. A travel demand model with an integrated spatial allocation land use module was used to expand the analysis beyond the narrow question of how mode choice changes within the zones that are subject to the transit-friendly parking policies. Parking supply and/or travel costs to zones with parking restrictions can be adjusted in the model to reflect the restrictions. Discouragement of car travel to some locations influences not only mode choice but can, over time, lead to changes in destination choice and land use patterns that can be detrimental to public transportation. The extent to which such land use changes will take place will depend, in large part, on the nature and implementation of existing land use policy. The desired reduction in automobile traffic is possible only if appropriate parking and business location policies are coordinated and enforced. A stringent parking policy without consideration of long-term impacts on land use development is likely to have little impact on networkwide automobile use but may cause a substantial decline in public transportation ridership.”

39. Transportation Sketch Planning with Land Use Inputs

(Lupa, Englund, Boyce, and Tatineni, 1995: Abstract)

“As a result of the 1990 Clean Air Act Amendments, greater attention is being focused on the regional land use policies available for mitigating congestion and reducing the total vehicle miles of travel. Land use changes are made using trip origins and destination flows from a sketch-planning network of the northeastern Illinois region and tested using a combined model of travel choice. Five general scenarios are considered: dense corridors, dense clusters, growth boundaries, urban infill, and a suburb-to-suburb rail project. The results indicate that compact patterns of regional densities for residence and employment with or without transit enhancements decrease many of the results related to vehicle miles traveled.

Future work with sketch networks and the combined model will involve link pricing, regional economic analyses, and air quality modeling.”

40. Regional Versus Local Accessibility: Implications for Nonwork Travel

(Handy, 1993: Abstract)

“The question of how alternative forms of development affect travel patterns has recently been the focus of a heated debate, much of which centers on the effects of suburbanization in particular. The concept of accessibility provides an important tool for resolving this question. By measuring both the accessibility to activity within the community, or ‘local’ accessibility, and the accessibility to regional centers of activity from that community, or ‘regional’ accessibility, the structure of a community is more fully characterized. The research summarized uses the concepts of local and regional accessibility to test the implications for shopping travel of alternative forms of development in a case study of the San Francisco Bay Area. The results show that higher levels of both local and regional accessibility are associated with lower average shopping distances but are not associated with differences in shopping frequency. As a result, higher levels of both local and regional accessibility are associated with less total shopping travel. However, the effect of high levels of local accessibility is greatest when regional accessibility is low and vice versa. These findings suggest that policies should be directed toward enhancing both types of accessibility, but that the effects may work against each other to some degree.”

41. Comparative Assessment of Travel Characteristics for Neotraditional Designs

(McNally and Ryan, 1993: Abstract)

“The claim that transportation benefits can be derived from neotraditional neighborhoods is explored. Conventional transportation planning models are used as tools to evaluate the performance differences of two hypothetical street networks designed to replicate a neotraditional and a conventional suburban community. Relative transportation benefits are measured in terms of vehicle kilometers traveled, average trip lengths, and congestion on links and at intersections. This comparison provides an assessment of how well the two networks in question deal with trips generated by the activities that they serve. All aspects of the modeled communities are held constant except for the actual configuration of the networks. The results of this evaluation indicate that equivalent levels of activity (defined by the land uses within the community) can produce greater congestion with conventional network structures and that corresponding average trip lengths are longer. The ultimate goal is to

determine if one network type, because of the nature of its design, can result in a more efficient transportation system. The results indicate that neotraditional designs can improve system performance.”

42. Transit-Based Housing and Residential Satisfaction

(Shaw, 1993: Abstract)

“Given increasing problems with automobile dependence, many planners, policymakers, and others are examining the potential for alternative land use patterns in urban areas, specifically developing increased densities around existing or planned transit stations or developing new communities that would be served by rail transit. However, rail transit systems require certain minimum densities at both origins and destinations to be successful. Given a choice of residential locations within a metropolitan area, it is an open question whether residents will choose to live at densities necessary to support various types of transit service. Past research that has dealt directly or indirectly with this question is examined. Residential satisfaction studies have the most to offer; these are reviewed in some detail, and key findings are summarized. Hedonic pricing studies are reviewed and contrasted with studies of residential satisfaction. The strengths and weaknesses of both approaches are discussed, and modifications are suggested where appropriate. Finally, current research on satisfaction with high-density, transit-based housing is described.”

43. Light-Rail Transit Stations and Property Values

(Al-Mosaind, Dueker, and Strathman, 1993: Abstract)

“What are the effects of proximity to light-rail transit (LRT) stations on the value of single-family homes? Two forces are at work. Proximity to LRT stations may improve the accessibility of residents to the central business district and the rest of the urban area. Further, proximity to rail stations may result in transportation cost savings for nearby residents. These effects should be positively capitalized in property values. Alternatively, without attention to design, LRT stations may impose negative externalities on nearby properties, with a resulting decline in house values. Which of these effects predominates in the housing market with respect to station proximity? A study was undertaken to analyze sale prices of homes in metropolitan Portland, Oregon. Two distance models to LRT stations were compared. The first showed a positive capitalization of proximity to LRT stations for homes within 500 m (1600 ft or 1/4 mi) of actual walking distance. This effect was equally felt for all homes within that distance zone. The second model found a statistically weak negative price gradient for homes within the

500-m zone. This implies a positive influence of proximity the closer the home is to an LRT station.”

44. Transportation, Congestion, and Density: New Insights

(Dunphy and Fisher, 1996: Abstract)

“Part of the case for higher density development is based on the belief that compact urban forms are more efficient than low density development known as suburban sprawl. Some broad relationships among driving, transit use, urban form, and congestion using urban area data, and special analysis of the 1990 National Personal Transportation Survey are examined. Although generally supporting the prevailing wisdom, the regional data show that there are other factors involved in explaining such differences, and the national household data present a less robust relationship. The national data show that there are significant differences in the household characteristics of persons living at different density levels — characteristics that are themselves important determinants of travel. Issues relating to these findings in the context of public policies on development and transportation are explored.”

45. Urban Form and Pedestrian Choices: Study of Austin Neighborhoods

(Handy, 1996: Abstract)

“Supporters of the New Urbanism suggest that the right design will encourage walking, thereby encouraging interaction and a greater sense of community and discouraging automobile dependence. Existing research provides insufficient evidence to support this belief, however, largely because of limitations in the data and methodologies that researchers have used. The research described moves beyond a simple test of correlations to an exploration of how urban form fits into a more comprehensive model of choices about pedestrian trips. First, a model for individual choices about pedestrian trips is proposed. Second, the results of a study of six neighborhoods in Austin, Texas, are presented. Data from a survey of residents in these neighborhoods support the proposed model and suggest that certain aspects of urban form can play an important role in encouraging walks to a destination but that the savings in travel from the substitution of walking for driving is likely to be small.”

46. Transit-Oriented Development in the Sun Belt

(Messenger and Ewing, 1996: Abstract)

“Although existing transit-oriented development manuals are chided for lack of empirical foundation[,] ... what is known from the empirical literature about the relationship between land use-urban design and

transportation is reviewed. More is needed to be known about this relationship. What was done in the first of two studies of transit ridership in Dade County is reported and what was learned of relevance to transit-oriented development is summarized. Bus mode share by place of residence proved primarily dependent on automobile ownership and secondarily on jobs-housing balance and bus service frequency. Automobile ownership, in turn, proved dependent on household income, overall density, and transit access to downtown. Thus, three types of variables — sociodemographic, land use, and transit service — were found to affect bus use through a web of interrelationships. Likewise, bus mode share by place of work proved dependent on the cost of parking, transit access to downtown, and overall density, again through a web of interrelationships. By using equations thus derived, densities required to support different levels of transit service and productivity were computed. It takes 8.4 dwellings per acre to support 25-min headways at the transit operator's minimum productivity level and 19.4 dwellings per acre at the system wide average productivity. As household incomes, parking costs, or other local conditions vary from the county average, required densities rise or fall accordingly. In any event, densities are likely to be well above the old industry standard of seven units per acre."

47. Land Use Impacts of the Houston Transitway System

(Mullins, Washington, and Stokes, 1989: Abstract)

"This research effort was directed toward assisting the Texas State Department of Highways and Public Transportation in the planning and impact evaluation of high-occupancy vehicle (HOV) lanes or transitways. The primary objective of this research effort was to measure, analyze, and evaluate the land use impacts of the construction of permanent transitways and park-and-ride facilities on freeway corridors in Houston, Texas. Given the relative newness of transitways in the nation, very little data have been collected or experience gained with the land use impacts of this type of transportation improvement. A review of the literature failed to identify any direct literature on this subject. A survey of operational transitways identified some locations where transitway facility land use impacts possibly had occurred. The prevailing opinion among transitway operators is, and evidence suggests, that land use impacts of transitways are likely to be highly localized and that transitways may induce some shifts in development and settlement patterns rather than generate entirely new development. This paper presents the results of before-after analyses of land use changes in the vicinity of a typical park-and-ride lot in Houston's North Freeway (I-45N) corridor. The results indicate that the land use impacts of the HOV treatments have been relatively insignificant. The study site showed only three possible instances of land use impacts. However, study areas in the corridors surveyed have substantial amounts

of undeveloped land, and it may prove necessary to wait until the transitways and associated support facilities become fully operational before a more definitive assessment of land use impacts is possible.”

48. Suburban Transport Behavior as a Factor in Congestion

(Prevendouros and Schofer, 1989: Abstract)

“Suburban congestion is among the most pressing transportation problems in large urban metropolises. One of the major causes of this problem is the changing transport behavior of people, created by a series of complex social, economic, technological, and cultural changes. Rapidly developing suburbs are a focal point for congestion in part because they are at the forefront of these changes. A conceptual framework has been established for identifying the channels through which various phenomena affect individuals and households, their orientation in life, and the decision-making process that results in manifest transport behavior. Several national trends in household structure, location patterns, incomes, lifestyles, social values, and norms, as well as in technology, are identified in this paper, and their effect on transport behavior is explored. To explore differences in demographics, household structure and commuting patterns among the central cities and growing and stable suburbs, a cluster analysis was performed using data from several suburbs and the central city of Chicago. Cluster results suggest that growing suburbs appear to be quite different from other areas in dimensions related to life-styles and transport behavior. Based on these results, useful solutions to the suburban congestion problem must be based on a more fundamental understanding of the underlying life-styles and transport behavior of suburban residents.”

49. Role and Function of Transit in Growth Management

(Miller, Coomer, and Jameson, 1989: Abstract)

“This paper explores how transit influences, or fails to influence growth in Florida and looks at ways to improve the role of transit planning in the growth management process. Needless to say, growth management is a significant concern in Florida. The issues discussed are presented in the context of the Florida experience. The transferability of this work is limited to the extent that some of the issues may not be relevant in areas where growth is not occurring. However, it is hoped that many will find the material instructive and helpful.”

50. Land Use and Transportation Planning in Response to Congestion

Problems: A Review and Critique

(Deakin, 1989: Abstract)

“Concerns over traffic congestion are producing an upsurge of interest in coordinating land development and transportation. This paper reviews land use and transportation planning at the local government level and assesses planning and policy issues raised by various strategies being utilized to address congestion problems. At the local level transportation and land use planning often are carried out as largely separate functions. This separation reflects differences in education and training of the planners responsible for land use and the engineers responsible for transportation and occurs in part because many transportation facilities and services are provided by state and regional rather than local agencies. One result is that transportation and land use plans are rarely coordinated and often are inconsistent. Such inconsistencies were less of a concern in the past, when the tradition of providing transportation services on demand lessened the need for detailed plan coordination. Today, however, shrinking revenues, escalating costs, and concerns about social and environmental impacts have combined to constrain state highway building; financial problems and difficulties in attracting riders have deterred transit expansion. Consequently, it is no longer possible to rely on state and regional transportation agencies to build a way out of congestion problems, and local governments are having to shoulder greater responsibility for transportation. Three approaches increasingly are being used by local governments as responses to congestion. First, developer exactions and impact fees are being imposed as ways to speed transportation project delivery. Second, transportation systems management programs and ordinances are being implemented to encourage the use of alternative modes and reduce the number of trips generated. Third, general plan, subdivision control, and zoning revisions are being made in order to tie land development more closely to available and planned transportation capacity. All three approaches suffer from uncertainties about their effectiveness and acceptability, particularly when applied piecemeal. Many local governments are not fully equipped to carry out these new tasks. Planning departments have few staff members with training in transportation planning and analysis and have left these matters largely to engineering departments. But many engineering departments also lack in-house transportation expertise, particularly concerning demand management and land use-transportation coordination. In addition, methodological and data shortcomings limit the ability of local planners and engineers to tackle land use and transportation planning issues. Equally important, the highly politicized circumstances under which many traffic mitigation efforts take place

thrusts planners into roles for which many have little training or experience. Planners often find themselves devising compromises between pro- and antigrowth interests, carrying out negotiations with developers and community groups, and preparing development revenue forecasts and financing plans. These findings suggest a need for additional research on methods to coordinate transportation and land use; more rigorous requirements and incentives for local transportation-land use coordination; greater cross-training of planners and engineers; and greater exposure of planning and engineering students to the techniques and issues of project evaluation, negotiation, and the political process.”

51. Decentralization of Jobs and Emerging Suburban Commute
(Levine, 1992: Abstract)

“Large-scale suburbanization of employment has dramatically changed transportation and land use planning. Intersuburban commuting now dominates regional highway networks, and the automobile has replaced mass transit for many commutes. A study was undertaken to examine one aspect of the debate on the effects of employment decentralization on regional mobility: the impact of growing suburban employment on the commutes of people from various income groups. The study suggests that suburban employment centers with high levels of multifamily housing will exhibit commute patterns in which household income and commute distance are largely independent. In contrast, in suburban areas in which the development of dense housing has not kept pace with employment growth, it is hypothesized that new commute patterns are emerging wherein lower-income households commute greater distances than their upper-income counterparts. This pattern would reverse the prediction of monocentric urban models for central city employment. These hypotheses are tested for San Francisco Bay Area communities using data from 1981 and 1989. Bivariate analyses generally support the predicted effects of community employment base and housing stock on commute patterns by income. Nested logit models of the household residential location decision were estimated for workers in San Ramon and in northern Santa Clara County on the basis of 1989 data. The models appeared to demonstrate a positive effect of the availability of multifamily housing on the residential location decisions of low- to moderate-income households. Forecasts of commute patterns using the estimated models indicated a potential for reducing long-distance commutes by low- to moderate-income households through a policy of encouraging multifamily housing construction in the vicinity of suburban employment centers.”

52. Location Planning for Companies and Public Facilities

(Verroen and Jansen, 1992: Abstract)

“One promising instrument for reducing car travel is the coordination of land use and infrastructure planning. Traditionally, this coordination has been tried by encouraging high-employment densities near public transportation stations. A more sophisticated strategy is based on the observation that companies generate a mobility of persons and goods that varies with the type of company and, naturally, its location. Companies are classified according to their potential use of public transportation. The land use strategy presented essentially consists of locating companies with a high potential use of public transportation near public transportation facilities, and locating those with a low potential use near highway exits. The results of an empirical investigation into the relationship between the mobility generated by companies (the mobility profiles), the type of company, and the accessibility characteristics of the locations (the accessibility profiles) are presented. These profiles have been elaborated for practical use in regional planning by the Netherlands Organization for Applied Scientific Research. An overview of the main results of these studies is given: first, a tentative classification of firms is introduced; then, the typology of locations is defined and operationalized. Evaluation and demonstration results of the developed profiles are presented. It is concluded that, with the use of the profiles, more integrated and comprehensive policies for land use and transportation planning can be developed.”

53. Factors Affecting Automobile Ownership and Use

(Prevedouros and Schofer, 1992: Abstract)

“Factors affecting automobile ownership, effects of the availability of company cars on automobile ownership and travel behavior, and effects of short-term household evolution on automobile ownership were explored using data from two low-density, outer-ring growing suburbs and two high-density, inner-ring stable suburbs. Major findings are summarized. The average number of automobiles per household in the sample was 2.02. The average share of trips by automobile (versus transit) was 84.6 percent for work trips and practically 100 percent for nonwork trips. Life-cycle stage is a major determinant of automobile ownership; its effect is highly non-linear. Changes in life-cycle stage alone may cause automobile ownership to increase (or decrease) substantially. Also, aging of children tends to increase automobile ownership. Location of residence or workplace, or both, and residence relocation into outer-ring, low-density suburbs affect automobile ownership positively, whereas workplace locations in the central city affect automobile ownership negatively because of the availability of high-quality commuter rail service.

The availability of company cars increases automobile ownership by 9 percent. The travel characteristics of those with company cars are affected significantly by the availability of an essentially free vehicle. There is some evidence that the increasing availability of company cars may increase daily vehicle miles of travel and, consequently, worsen traffic congestion.”

54. Residential Density and Travel Patterns

(Steiner, 1994: Abstract)

“With the increasing concern about the environmental side effects of the use of the automobile, a few researchers, real estate developers, and increasingly policy makers in many states argue for the need for infill housing, mixed land uses, and increased density, especially around transit stations. In making these recommendations they make several assumptions about the relationship between high-density residential development and transportation choices and the resultant environmental impacts. They assume that people in high-density developments will make fewer and shorter trips and walk or use transit more frequently than residents of other areas. Furthermore they often assume that people will be willing to move to high-density areas and, when they do, will change their travel patterns. Several sets of the literature are explored to gain a better understanding of the interactions between the household in high-density residential areas, the land-use characteristics of the area, and the transportation choices of households.”

55. Impacts of Mixed Use and Density on Utilization of Three Modes of Travel

(Frank and Pivo, 1994a: Abstract)

“Findings from an empirical analysis to test the impacts of land-use mix, population density, and employment density on the use of the single-occupant vehicle (SOV), transit, and walking for both work trips and shopping trips are presented. The hypothetical relationships tested focused on whether there is a relationship between urban form and modal choice, whether this relationship exists when controlling for non-urban form factors, whether this relationship is linear or nonlinear, and whether a stronger relationship exists between modal choice and urban form when they are measured at both trip ends as opposed to either the origin or destination. A review of the literature and experiences suggested that a fair amount of information is known about the impacts of density of mode choice. However, considerable debate exists over whether density itself is actually the causal stimulus or a surrogate for other factors. To address this issue a data base was developed with a comprehensive set of variables for which density may be a proxy, for example, demographics

and level of service. This analysis employed a correlational research design in which mode choice was compared among census tracts with differing levels of density and mix. Findings from this research indicate that density and mix are both related to mode choice, even when controlling for non-urban form factors for both work trips and shopping trips. Furthermore, the relationship between population and employment density and mode choice for SOV, transit, and walking is nonlinear for both work and shopping trips. Transit usage and walking increase as density and land-use mix increase, whereas SOV usage declines. The findings from this research suggest that measuring urban form at both trip ends provides a greater ability to predict travel choices than looking at trip ends separately. The findings also suggest that increasing level of land-use mix at trip origins and destinations is also related to a reduction in SOV travel and an increase in transit and walking.”

**56. Effect of Neotraditional Neighborhood Design
on Travel Characteristics**

(Friedman, Gordon, and Peers, 1994: Abstract)

“Neotraditional neighborhood design (NTND) developments receive increasing attention as an alternative community design to standard suburban developments. By altering the spatial relationships through changes in zoning and transportation systems, automobile use is expected to be reduced. NTND requires the close proximity of residential and nonresidential uses connected with a straight, interconnecting street system and a network of bicycle paths and pedestrian walkways. Changes to the geometric design of streets reduce vehicular speeds. NTND has much in common with traditional developments. Because few NTNDs are built the authors researched trip files to see if residents of traditional (e.g., pre-World War II) and suburban (e.g., post-World War II) residential developments exhibit differing travel habits. The effects of traditional and standard suburban community design on household trip rates are evaluated. The analysis uses data from a 1980 regional travel survey of San Francisco Bay Area households. The findings indicate that households in newer suburban tract communities use vehicle more, whereas households in traditional communities rely more on alternative modes of transportation. When considering the results of the study for NTND design, remember that not all mode choice factors that exist in older traditional-designed communities would be duplicated in a modern NTND. The findings show that community design and urban form have a significant influence on travel behavior. However, more research is needed to identify the relative

influences of household income, automobile ownership, and other socioeconomic factors on trip generation and mode choice.”

57. Land Use Transportation Models for Policy Analysis

(Mackett, 1994: Abstract)

“The objective is to assess the ability of land use transportation models to address some current policy issues. The nature of the relationship between land use and transportation is examined briefly in terms of empirical evidence and the results from modeling exercises. Two studies that use such models and that are being carried out in Britain are examined. Despite these and some convincing arguments by experts, there is little evidence of widespread use of such models. A number of current policy issues are discussed, and then a set of policy instruments that can be used to meet the policy objectives are identified. Evidence on the ability of land use transportation models to represent the impacts of the policy instruments is presented. It is shown how such models can contribute significantly in some areas of policy analysis, for example, reducing congestion and energy use, but can contribute very little to the objective of moving toward a market economy.”

58. Impacts of Commuter Rail Service as Reflected in Single-Family Residential Property Values

(Armstrong, 1994: Abstract)

“Limited empirical evidence currently exists concerning the capitalization effects of commuter rail facilities. Both positive and negative influences may be present. Transportation agencies and property owners often differ in their views over both the existence and the extent of such impacts from commuter rail facilities, and resulting public participation can have a significant impact on the planning and design process of commuter rail facilities. Single-family residential properties in metropolitan Boston, Mass., are examined. Results indicate that there is an increase in single-family residential property values of approximately 6.7 percent by virtue of being located within a community having a commuter rail station. At the regional level there appears to be a significant impact on single-family residential property values resulting from the accessibility provided by commuter rail service. Findings related to commuter rail-generated right-of-way proximity effects are inconclusive. The potential policy implications of these findings are discussed in the context of property value impacts associated with the construction and operation of new commuter rail facilities.”

59. The Effect of Future Trends on Trip Patterns, Urban Commercial Structure, and Land Use

(Shortreed, May, and Dust, 1985: Abstract)

“The ‘Third Wave’ or the information society is changing our society. The major effects are: (a) reduction in traditional labor activities such as manufacturing and data gathering; (b) growth in jobs that deal with information; such jobs can be located almost anywhere, including the home; and (c) growth in available leisure time, and an increase in the potential for achieving living style objectives. One possible outcome of these major effects is a dramatic restructuring of urban areas including the decentralization of urban nodes over a whole region. This is in direct contrast to the industrial society in which the urban structure has a highly centralized, hierarchical form focusing on the regional or metropolitan city as aptly described by central place theory. This growth pattern reversal dramatically changes the requirements for transportation facilities from those contained in existing transport facility plans. The effect of the third wave may result in the placement of many existing plans at risk in that the projected transport demands may not materialize. In this paper an approach to evaluating the risks to transport investment in southern Ontario is described. A series of exploratory models is being developed to implement the concepts presented in the paper. By incorporating other dimensions of the locational behavior of individuals, these models are extensions of economic base theory and the Lowry model.”

60. Effects of Freeway Stage Construction on Nearby Land Uses and Vehicle User Costs

(Buffington, Chui, and Memmott, 1985: Abstract)

“Because of the huge costs involved, most freeways are commonly constructed in lateral or longitudinal stages. In the case of lateral stage construction, service roads are constructed and opened to traffic before the main lanes are constructed on a freeway section-by-section. Impacts of stage construction include adjacent area land use development, user travel time costs, vehicle running and speed change costs, and accident costs. This paper contains the findings of a study of stage construction impacts on two freeways located in Houston, Texas: (a) one completely stage constructed and (b) the other partly stage constructed. Although authorization was given to purchase right-of-way for both freeways within 2 years of each other, the second freeway to receive authorization was completed at least 6 years before the first. During the ‘before’ construction period, the socioeconomic characteristics of the areas adjacent to the two freeways are shown to be generally similar. During the construction and ‘after’ periods these characteristics are shown to be dissimilar, partly because of differences in the construction schedules of

the two freeways. A regression analysis of historical land use changes reveals that certain land uses are sensitive to nonstaged freeway construction. Other variables such as abutting and nonabutting, freeway location differences, capacity changes, and average daily traffic volumes are included in the analysis. A user analysis reveals that staging a freeway costs more in vehicle user costs than benefits gained from delaying construction expenditures.”

**61. Evaluation of Economic and Development Impacts
of Major Transit Investments**
(Lee, 1981: Abstract)

“Policymakers incorporate information on economic and development impacts in their evaluation of major transit investment alternatives, and there are good reasons for doing so. The information they use, however, is rarely suitable for evaluation. Deficiencies range from highly formal and detailed multiplier analyses that answer the wrong questions to highly heuristic arguments that cannot distinguish one alternative from another. Claims regarding jobs, property values, and urban form, for example, are often spurious. Transportation planners tend to underestimate both the importance of economic and development impacts and the difficulties in evaluating them. The task is to formulate the empirical questions to focus on potential real benefits and to estimate the magnitude of the benefits in the specific case. Precise answers will never be obtained, but at least the analysis can be directed to the applicable concepts.”

62. Evaluation of Two Residential Models for Land Use Allocation
(Khisty, 1981: Abstract)

“The current thrust in transportation planning is to make greater use of manual and partly computerized techniques for providing quick-response travel estimation. In this context, land use models, which fuel the typical transportation models, are needed for small and medium-sized cities that operate on a small budget. The results of the evaluation of two operational residential land-use-allocation techniques most suitable for use in small and medium-sized cities are recorded. In an ex post facto test, both techniques were applied in a common setting and the U-statistic was used as a measure of performance. The results were excellent.”

63. Land Use-Transportation Analysis System for a Metropolitan Area

(Nakamura, Hayashi, and Miyamoto, 1983: Abstract)

“Results are reported of a study conducted to develop a land use-transportation analysis system that will be useful for assessing impacts of transportation improvements. The study consists of two major parts. The purpose of the first part is to develop models that adequately describe the locational behavior of land uses and consequently forecast future land use patterns. The purpose of the second part is to develop a computer-aided analysis system that makes it possible to manage a complex array of integrated programs by man-machine interactive methods. The land use-transportation model has a hierarchic structure that first allocates land use demand into city-sized zones and then into 1-km grids. The allocation model for the zone level has a Lowry-type structure, but each submodel for industrial, business, and residential uses is based on its own locational behavior. The allocation model for the grid level describes competition among land uses under constraints of zoning regulations according to the principle of maximization of locational surplus. Transportation conditions are determined by estimating trips generated from new locations. The location of land uses and transportation conditions interact in the model. The computer-aided system contains a data base system for data processing of land use-transportation analysis as well as an interactive operation system that uses computer graphics and a hierarchic menu for program execution. To illustrate this system, future changes of land use and transportation in the Tokyo metropolitan area due to the proposed Tokyo Bay Bridge are forecast.”

64. Work Location Estimation for Small and Rural Areas

(Stephanedes and Eagle, 1983: Abstract)

“A disaggregate specification for job search location choice is developed based on a binary logit structure. The proposed model includes a set of economic and a set of transportation level-of-service variables and can be used for implementing transportation and economic policies to improve service-area economic development. Transportation and socioeconomic data from four Minnesota towns — Cloquet, LeSueur, Austin, and Albert Lea — are used for model testing and validation. The proposed specification predicts job search destination choice correctly up to 77 percent. Despite substantial differences across test town pairs, parameter statistical significance generally increases with sample size and model predictive power is not strongly influenced by location of application. Travel conditions for the period of expected employment are found to play a role in

determining location choice. For all communities studied, expected length of employment is the strongest determinant of choice.”

65. Shaping a Suburban Activity Center Through Transit and Pedestrian

Incentives: Bellevue CBD Planning Experience

(Noguchi, 1982: Abstract)

“Downtown Bellevue is a typical suburban central business district (CBD) and is emerging as one of the major activity centers in the metropolitan Seattle region. With cooperation from transit and other agencies, the City of Bellevue took several actions related to land use and transportation in recent years. In essence, the City’s goal is to direct the anticipated growth to create a people-oriented urban activity center through transit, pedestrian, and other incentives. Actions taken on parking management, the pedestrian mall, the transit center, and the incentive transit service agreement will have significant impacts on the intensity of activity and the pattern of development in the Bellevue CBD. The City has adopted land use regulations necessary to transform the suburban automobile-oriented center into an urban activity center designed for people. However, land use regulations alone will not be enough to achieve this goal. If land use regulations are closely coordinated with transportation elements, such as those described here, the impacts would be much greater. The experiences gained during the Bellevue CBD planning process are valuable to others who are working in similar circumstances in other parts of the nation if planners and decision-makers hope to transform a suburban automobile-oriented CBD into a people-oriented activity center.”

66. Land Use Change in Suburban Clusters and Corridors

(Baerwald, 1982: Abstract)

“Diversified land use concentrations comparable with downtown in their range of functions developed in American suburbs in the last few decades. These concentrations take two forms — clusters, which usually focus on a regional shopping center, and corridors, which develop along freeways. Examples of their development are presented in case studies of the Southdale Cluster and the I-494 Corridor south of Minneapolis. Four general factors affect cluster and corridor development: (a) variations in the locational tendencies of different land uses, which lead comparison goods stores and higher-value residences to locate in clusters, while automobile dealers, industrial plants, and warehouses are more likely to be in corridors; (b) characteristics of the transportation system, including metropolitan freeway configuration, local characteristics within a concentration, and proximity and access to other modes; (c) historical factors and the timing of development; and (d) other factors, including

social and demographic patterns, local governmental impacts, and entrepreneurial prerogative. Clusters and corridors developed in response to heavy reliance on automobiles and trucks. These modes will remain preeminent in the foreseeable future.”

67. Defining Regional Employment Centers in an Urban Area
(Dunphy, 1982: Abstract)

“Suburbanization of employment in urban areas has reduced the significance of the traditional downtown not only for shopping but also for commuting. However, there are no standard definitions of suburban employment centers comparable with those of central business districts. This paper describes a study of regional employment centers within the Washington, D.C., area. Guidelines are given for applying the technique to other regions. An empirical definition of employment centers was developed based on a detailed investigation of employment concentrations throughout the region. Criteria were developed based on size of the center, area, and specialization of employers. The study made use of a 1974 census of employment, aerial photography, and U.S. Census maps.”

68. Living on the Edge: The Costs and Risks of Scatter Development
(Sorensen and Esseks, 1998)

a. Abstract

“In a unique study, researchers from Northern Illinois University and American Farmland Trust found that scatter development in the Chicago suburbs is often subsidized by those living in adjoining municipalities. Furthermore, for many living in these far flung houses and subdivisions, the emergency response times for police, ambulance and fire fighters may exceed national standards. For the first time, NIU and AFT researchers have been able to identify and define at least three patterns of scatter development common to the Chicago region. This may also be the first time anyone has documented the effects of scatter development on the delivery of emergency services.”

b. Findings

“The American dream has always equated wide open spaces with a better life. In the suburbs around Chicago, this dream plays out as people move farther and farther from established cities in search of a bigger home, on a bigger lot at a better price. Indeed, new development in the suburbs is commonly considered the key to economic prosperity for these

communities. But is this growth bringing financial health and building a stronger quality of life for these communities or is new growth hurting them?

“American Farmland Trust commissioned the following study by Northern Illinois University researchers to begin to answer these questions. For the first time, we define at least three patterns of scatter development, typical of the growth seen in the Chicago suburbs. Scatter development is a form of what is commonly referred to as urban sprawl. It is characterized by homes on large lots or by widely scattered subdivisions (see Glossary in Appendix 1). We find, despite the large assessed valuations of houses in scatter developments, that the cost of providing services to those homes is often subsidized by those living in more modest homes in the adjacent towns. And, for the first time, the effects of scatter development on the delivery of emergency services are documented.

“In short, this study finds that homes in scatter development sites:

- do not generate enough taxes to educate the children who live there;
- fall woefully short of paying to maintain the roads leading to and through their subdivisions;
- and, where municipal water and sewer services are available, the costs of building that infrastructure may be paid by other taxpayers.

“Equally alarming, this study shows that those living in these remote locations often face some increased risks to their personal safety. In the areas studied:

- police response times were as much as 600 percent longer, on average, than in the adjoining municipality
- ambulance response times were as much as 50 percent longer
- fire response times were as much as 33 percent longer.”

69. How Sprawl Costs Us All (Camph, 1995)

“For 40 years, American cities and towns have had to live with the unintended consequences of transportation policies not guided by concepts of community, equity, and quality of life, but rather driven by a decision making paradigm, which unconsciously assumed, a priori, that transportation is somehow a value-free instrumentality of people's desires

to get from A to B, no questions asked. Since the Interstate era began in 1956, transportation has been viewed by planners and politicians alike as being primarily, often entirely, a matter of supporting the economy.

“In effect, large portions of our society (e.g., our central cities, the elderly, the poor, women with both job and family responsibilities) have been consigned to the backwaters of transportation policy and decision-making. Across the United States, transportation investment strategies have combined with discriminatory housing practices and federal tax policies to create metropolitan areas with economically robust suburbs surrounding sick and decaying urban cores.

“What's more, we're about to repeat this human and ecological disaster as older suburbs are deserted in favor of ever more sprawling — and auto dependent — ex-urbs. "The nation that invented the throwaway city is now creating the throwaway suburb," says real estate consultant Charles Lockwood, as quoted by Paul Glastris of U.S. News and World Report.

“America's transportation policies since the dawn of the Interstate era, and the land-use patterns and urban forms which they helped spawn, have had visible, astronomical — but oddly dissociated — fiscal and human costs.

“Jim MacKenzie and Roger Dower of the World Resources Institute and Don Chen of STPP estimate that the total market, external and motor vehicle accident costs not borne by users could be as high as \$355.7 billion per year.

“In addition, if our nation's metropolitan sprawl continues unabated, an assortment of additional hidden costs will continue to accrue on the nation's public and personal ledgers. Here's how it works (and has been working for over 40 years):

- Start with the ‘American dream,’ the stand alone, single family home. Where is land cheap and taxes low? At the fringes of the metropolitan area. How do we get there? Not a problem, the state DOT will build or widen a freeway using taxes collected from urban, suburban, and rural citizens alike. This is Hidden Cost No. 1.
- Developers, having received the benefit in terms of publicly provided access, then get the benefit of Hidden Cost No. 2 as people buy the developers' relatively affordable homes, made more affordable by the federal mortgage tax deduction. In fact, the post-war suburban boom was largely fueled by another huge federal subsidy — the VA loan program. The same developers then develop suburban

business parks, made possible by publicly funded beltway and suburban interstates.

- But as people begin to populate the urban fringe, they demand public services, and highway infrastructure is only a small portion of the total cost of development that impacts a region. Providing services such as local roads, fire and police protection, water, sewer, and schools to sprawling suburban locations creates Hidden Cost No. 3. Typically, these costs are borne by people already there, not by the new arrivals.
- As the urban core is abandoned, and as transportation linkages between where poor people live and where the jobs are become ever more tenuous, the undeniable costs of an unbroken cycle of poverty, unemployment, crime, and dependence on public assistance is Hidden Cost No. 4, and it is borne by everyone.
- In fact, H. V. Savitch and his colleagues at the University of Louisville School of Urban Policy, in a comprehensive study of the relationship between center cities and their suburbs, concluded that self-sufficiency of suburbs 'is an impoverished idea.' They reported, 'Suburbs which surround healthy cities stand a better chance of vitality than those that surround sick cities.' This might be Hidden Cost No. 5, and it would appear to be borne by the suburbanites themselves.
- Finally, people need to get to jobs, shopping, and social and recreational destinations. Because public transit hasn't figured out a way to work very well in low density suburbs, there is but one choice: the automobile. Because of our low urban densities, fuel consumption in American cities is about five times higher than in European cities, and the annual cost of congestion per capita in our major metropolitan areas has been estimated by the Texas Transportation Institute to be as much as \$650. That's Hidden Cost No. 6.
- And so it goes. The end result is metropolitan areas with a torn social fabric, with their sense of community atomized, with the poor and minorities relegated to a decaying urban core, and with car-dependent suburbs sinking deeper into a cultural and spiritual malaise.

"Transportation didn't do all that by itself, but it certainly helped. The question now is: what's to be done to reverse these trends, and how will America settle the 80 million new people it will have by the year 2020?"

“Ironically, involvement in transportation by institutions whose primary concern is empowering and assisting people and communities in our cities has been mostly peripheral. Social service agencies, health care providers, charitable organizations, community activists, and philanthropic foundations seem to have accepted the notion that the transportation system is a constraint to be coped with, not a potential asset to help carry out their primary missions.

“ISTEA has the potential to change all that. The readers of this article are challenged to join in the effort to seize the opportunity provided by the ISTEA to help achieve an American transportation future where people are the ultimate bottom line.”

70. Ahawahnee Principles: Toward More Livable Communities (Corbett and Velasquez, 1999)

“Cities everywhere are facing similar problems — increasing traffic congestion and worsening air pollution, the continuing loss of open space, the need for costly improvements to road and public services, the inequitable distribution of economic resources, and the loss of a sense of community. The problems seem overwhelming and we suffer from their consequences every day. City character is blurred until every place becomes like every other place and all adding up to No Place.

“Many of our social, economic and environmental problems can be traced to land use practices adopted since World War II. In the late 1940's we began to adopt a notion that life would be better and we would all have more freedom if we planned and built our communities around the automobile. Gradually, rather than increasing our freedom, auto-oriented land use planning has reduced our options. Now, it takes much more time than it used to carry out our daily activities. We must go everywhere by car — there is no other option. We must take a car to the store for a gallon of milk, drive the children to Little League practice, even spend part of the lunch hour driving to a place to eat. And as roads become increasingly clogged and services further from our home, we spend our time as anonymous individuals waiting for the traffic light to change rather than chatting with friends at the corner store or playing ball on the lawn with the neighborhood kids.

“Rather than designing towns so that we could walk to work or to the store, we have separated into homogeneous, single-use enclaves, spreading out these uses on ever-increasing acres of land. Housing of similar types for similar income levels were grouped together. Retail stores were clustered into huge structures called malls, surrounded by endless acres of parking slots. Businesses imitated the mall — creating

"business parks", usually without a park in sight, and with people working in clusters of similar buildings and parking spaces. At the same time, public squares, the corner store, main street, and all the places where people could meet and a sense of community could happen were replaced by the abyss of asphalt.

"Even people are segregated by age and income level. And those who cannot drive or who cannot afford a car face an enormous disadvantage. In the words of Pasadena's Mayor Rick Cole, 'there's a loss of place, a loss of hope, and it's killing our souls.'

"The effects of single-use, sprawling development patterns are becoming increasing clear. And, with that has evolved arealization that there is a better way. Towns of the type built earlier in this century — those compact, walkable communities where you could walk to the store and kids could walk to school, where there was a variety of housing types from housing over stores to single-family units with front porches facing tree-lined, narrow streets — these towns provided a life style that now seems far preferable to today's neighborhoods. Thus we have seen an increasing interest in a number of concepts that would bring us back to a more traditional style of development and a style of planning that would be more in tune with nature including 'neotraditional planning', 'sustainable development', 'transit-oriented design', the 'new urbanism', and the concept of 'livable' communities.

"In 1991, at the instigation of Local Government Commission staff-member Peter Katz, author of the New Urbanism, the commission brought together a group of architects who have been leaders in developing new notions of land use planning: Andres Duany and Elizabeth Plater-Zyberk, Stefanos Polyzoides and Elizabeth Moule, Peter Calthorpe, and Michael Corbett. These innovators were asked to come to agreement about what it is that the new planning ideas — from neotraditional planning to sustainable design — have in common and from there, to develop a set of community principles. They were then asked how each community should relate to the region, and to develop a set of regional principles. Finally, they were charged with defining how these ideas might be implemented by cities and counties. The architects' ideas were drafted by attorney Steve Weissman into a form which would be useful to local elected officials and provide a vision for an alternative to urban sprawl. A preamble, topics of specific ideas, community principles, regional principles and implementation of the principles was presented in the fall of 1991 to about 100 local elected officials at a

conference at the Ahwahnee Hotel in Yosemite. There they received both a highly enthusiastic response and their title — the Ahwahnee Principles.”

a. Community Principles

“The community principles define a community where housing and all the things needed to meet the daily needs of residents are located within walking distance of one another. They call for returning to historic population densities around transit stops to provide the critical mass of people and activities in these areas needed to make transit economically viable. They call for housing which provides places to live for a variety of people within a single neighborhood instead of separating people by income level, age or family situation.

“The Ahwahnee Principles state that development should be compact but with open space provided in the form of squares or parks. Urban designer Michael Freedman describes this as space-making rather than space-occupying development. Rather than surrounding buildings in the center of unusable landscaped areas (space-occupying development), Freedman says we should use buildings to frame public space (place-making design).

“Freedman holds that to plan for more livable communities, local government officials must understand the human scale — that is, the basic relationship of people to the environment in which they live. In neighborhoods, for example, we must recognize the relationship of the house to the front door to the street. In doing so, we will create the sorts of places which bring people together and create a vitality, a sense of community. By framing open space with buildings which open onto it, there are more eyes to look upon the area and that creates places that feel more safe. And with that design solution comes more compact development — development which has less costly infrastructure requirements, and development which is more walkable and more easily served by transit.

“Further, the principles call for an end to the monotony of contiguous, look-alike building by separating each community with a well defined edge, such as an agricultural greenbelt or wildlife corridor, so that we can actually see where one community ends and another begins. From a transportation standpoint, one of the most important principles is that all parts of the community should be connected by streets or paths — no more dead end cul de sacs, fences, or walls which prevent us from going directly from one point to another. Narrow streets, rather than wide streets, are recommended because they help slow traffic and make it safer for pedestrians and bicycles. Narrow streets also create more

attractive, more people-friendly neighborhoods and shopping districts.

“Finally, the community principles call for more resource-efficient land use planning — the preservation of the natural terrain, drainage and vegetation; and the use of natural drainage systems and drought tolerant landscaping and recycling. They ask that buildings be oriented properly, (as required by the California solar rights act) so that they can take advantage of the sun for heating and natural breezes for cooling.”

b. Regional Principles

“The regional principles call for the land-use planning structure to be integrated within a larger network built around transit rather than freeways, with regional institutions and services located in the urban core. A perfect example of this can be found in the City of San Jose where city planners chose to locate a new sports stadium in the downtown area, close to several rail stops rather than off a freeway. The surrounding restaurants and shops are benefiting from the increased number of passers-by before and after games, and freeway travel is not as clogged as it otherwise would have been.

“The architects noted that regions should be distinct from one another rather than fading into one another as they largely do today. Each region should be surrounded by a wildlife corridor or greenbelt and the materials and methods of construction should be specific to the region. Santa Barbara and Santa Fe come forward as two excellent examples of communities who have followed these principles and who have realized that there are economic as well as aesthetic advantages of doing so. Both of these cities have implemented strict design guidelines for their downtowns which preserve the historical architectural styles of their regions. Because these cities have retained a very special and distinct sense of place, they have become highly popular both as places to live and as tourist destinations.”

c. Implementation Principles

“The implementation strategy forwarded by the planners is fairly straightforward and simple. First, the general plan should be updated to incorporate the Ahwahnee Principles. Next, local governments should take charge of the planning process rather than simply continuing to react to piecemeal proposals.

“Prior to any development, a specific plan or a precise plan should be prepared based on the planning principles. With the adoption of specific plans, complying projects can then proceed with minimal delay. The

developer will know exactly what the community wants. There should be no more costly, time-consuming, guessing games.

“Finally, the architects put forth the most critical principle of all, ‘Plans should be developed through an open process and participants in the process should be provided visual models of all planning proposals.’ Without involving citizens from every sector of the community, including developers, the political viability of a new plan may be limited. Citizens must be getting what they want and care enough to be vigilant about it so that the plan cannot be changed by a single property owner with a self interest.

“But the stability of planning policies is not the only advantage of citizen participation. Bringing together citizens to create a common vision for the community has more benefits than just the creation of a good plan that will be upheld through time. The process itself can create a sense of community and an understanding between previously warring factions.

“However, it is difficult for citizens to visualize what a new planning scheme is going to look like after it is built if they see only a one-dimensional sketch or read about the plan in a six-inch thick planning document. There are a number of techniques which have been developed to address this problem. The visual preference survey, where participants are provided an opportunity to express their likes and dislikes through judging slides, allows citizens to actually see concrete examples of their options. Another useful technique is computer simulation where the visual results of a physical plan can be created on the computer. Another method involves taking participants on a walk through their own town to determine which portions of the community look good and function well and which do not.”

d. Implementing the Ahwahnee Principles

“The concepts embodied in the Ahwahnee Principles are being implemented by cities and counties throughout the nation, with most of the activity occurring on the east and west coasts. In Pasadena, the participation of 3,000 residents from all sectors of the community resulted in a general plan with a guiding principle which states, ‘Pasadena will be a city where people can circulate without cars.’ The plan lays out where growth should occur — primarily along light rail stations and in neighborhood commercial areas within walking distance of residences. The city is now preparing specific plans to guide what that growth should look like. One of the projects, a

mixed-use housing development near a downtown rail stop, is already complete.

“In San Jose, the City has produced, under the guidance of citizen advisory groups, a total of four specific plans for infill sites in various parts of the City covering a total of almost 1,000 acres. Their goal is to assure that new development will occur as compact, mixed use neighborhoods located near transit stops. The City of San Diego has adopted ‘Transit-Oriented Development Design Guidelines’ for the purpose of redirecting existing patterns of building within the City and helping reduce the community's dependence on the automobile. The planning staff has completed the first public review draft of a comprehensive zoning code update that will create zoning designations to implement the guidelines.

“In Sacramento, Walnut Creek, Santa Barbara and San Diego, city officials have broken new ground by siting new shopping malls downtown, near transit, rather than off a freeway. The benefits include both a new surge of economic activity for downtown businesses and a reduction in auto use and the associated negative air quality impacts. The California Air Resources Board has noted that over 60% of the people arriving at San Diego's downtown mall, Horton Plaza, arrive via transit or walking.

“Developer-proposed, large-scale, new development is also reflecting the influence of the Ahwahnee Principles. The one-thousand acre, Playa Vista infill project in Los Angeles will include the preservation of 300 acres of wetlands. As it is designed now, the development will feature moderately-dense housing built around small neighborhood parks. Large offices, small retail stores, restaurants, grocery stores and small telecommuting offices will be integrated, allowing residents to walk when they go to work, shop, or go out to dinner. A bicycle and pedestrian esplanade will link the town with the beach. Rialto's Mayor John Longville is working with the developer of a 3,000 acre development near the Ontario airport to incorporate the concepts of the Ahwahnee Principles in that project.

“With the assistance of urban designer Michael Freedman, the City of Cathedral City is no longer focusing solely on density and the control of uses as a means of guiding their future growth. At a joint meeting of the city council, planning commission, and architectural review committee, Freedman presented the Ahwahnee Principles and the key role of local government in future planning and general plan development. Cathedral City adopted the Ahwahnee Principles by resolution and has started to incorporate them into their general plan. With only 50% of the city built out and development plans on the table, the city council acknowledged the importance of having planning guidelines. An innovative city in the desert

region, Cathedral City understands that the best way to deliver good planning principles is to work both with the community and the building industry to develop a comprehensive strategy of planning more livable neighborhoods.

“Even the US government has embraced the Ahwahnee Principles. Architect Peter Calthorpe reports that the planning concepts outlined by the Ahwahnee Principles have been written into a guidance document recently published by the federal government. Calthorpe was a coauthor of the document, *Vision/Reality* produced by the US Department of Housing and Urban Development for local government officials interested in applying for Community Development Block Grant program and other funds.

“A number of city planners believe that if they can just solve the problem of traffic, they can solve the major problems of their cities. Yet the simple needs of the automobile are far more easily understood and accommodated than the complex needs of people. The Ahwahnee Principles outline a set of ideas for planning more livable communities built for people, not just cars, and provide a vision for an alternative to urban sprawl. This new vision will lead to neighborhoods where people no longer live in a house with an isolated rear yard. They will live in a home with a comfortable relationship to the street which is part of a neighborhood. Tree-lined sidewalks with narrow streets will induce cars to drive more slowly. Children will be more safe when they play in the neighborhood and the sense of community will add a feeling of security. When they need to go to school, to the store, or to baseball practice, children will be able to walk or ride a bike rather than being dependent on someone driving them there.

“The top down, traditional planning of yesterday is no longer an acceptable means of making cities. The people served must be involved. When people come together and openly discuss their visions for the future, a sense of community will result. Bringing citizens into the process of developing and revising the general plan will also result in new development which both serves the needs of the community and is used and respected by the residents it serves. To make better, more livable cities, local governments must take charge of the process of planning while involving and utilizing its best asset, the people who work, live and play in our communities.”

e. About the Architects

“The architects who gathered in 1991 to develop the Ahwahnee Principles are all internationally known for their inspirational work and innovative

ideas. Peter Calthorpe, is one of the leaders of the 'New Urbanism' movement and was cited by Newsweek Magazine as 'one of 25 innovators on the cutting edge.' Michael Corbett, a former Mayor of the City of Davis, has received international recognition for his design of the resource-efficient Village Homes development in Davis, a project often cited as the best existing example of sustainable development in the world. The husband-wife team of Andres Duany and Elizabeth Plater-Zyberk, made headlines with their wildly successful Seaside development in Florida and have become highly acclaimed architects and planners of neotraditional communities. Stefanos Polyzoides is an associate professor of architecture at the University of Southern California. He and his partner, Elizabeth Moule, are the architects of Playa Vista in Los Angeles, a model application of the Ahwahnee Principles."

f. The Ahwahnee Principles

(1) Preamble

"Existing patterns of urban and suburban development seriously impair our quality of life. The symptoms are: more congestion and air pollution resulting from our increased dependence on automobiles, the loss of precious open space, the need for costly improvements to roads and public services, the inequitable distribution of economic resources, and the loss of a sense of community. By drawing upon the best from the past and the present, we can plan communities that will more successfully serve the needs of those who live and work within them. Such planning should adhere to certain fundamental principles."

(2) Community Principles

1. "All planning should be in the form of complete and integrated communities containing housing, shops, work places, schools, parks and civic facilities essential to the daily life of the residents.
2. "Community size should be designed so that housing, jobs, daily needs and other activities are within easy walking distance of each other.
3. "As many activities as possible should be located within easy walking distance of transit stops.
4. "A community should contain a diversity of housing types to enable citizens from a wide range of economic levels and age groups to live within its boundaries.

Land Use Planning ■

5. “Businesses within the community should provide a range of job types for the community's residents.
6. “The location and character of the community should be consistent with a larger transit network.
7. “The community should have a center focus that combines commercial, civic, cultural and recreational uses.
8. “The community should contain an ample supply of specialized open space in the form of squares, greens and parks whose frequent use is encouraged through placement and design.
9. “Public spaces should be designed to encourage the attention and presence of people at all hours of the day and night.
10. “Each community or cluster of communities should have a well-defined edge, such as agricultural greenbelts or wildlife corridors, permanently protected from development.
11. “Streets, pedestrian paths and bike paths should contribute to a system of fully-connected, interesting routes to all destinations. Their design should encourage pedestrian and bicycle use by being small and spatially defined by buildings, trees and lighting; and by discouraging high speed traffic.
12. “Wherever possible, the natural terrain, drainage and vegetation of the community should be preserved with superior examples contained within parks or greenbelts.
13. “The community design should help conserve resources and minimize waste.
14. “Communities should provide for the efficient use of water through the use of natural drainage, drought tolerant landscaping and recycling.
15. “The street orientation, the placement of buildings and the use of shading should contribute to the energy efficiency of the community.”

(3) Regional Principles

16. “The regional land-use planning structure should be integrated within a larger transportation network built around transit rather

- than freeways.
17. “Regions should be bounded by and provide a continuous system of greenbelt/wildlife corridors to be determined by natural conditions.
 18. “Regional institutions and services (government, stadiums, museums, etc.) should be located in the urban core.
 19. “Materials and methods of construction should be specific to the region, exhibiting a continuity of history and culture and compatibility with the climate to encourage the development of local character and community identity.”

(4) Implementation Principles

20. “The general plan should be updated to incorporate the above principles.
21. “Rather than allowing developer-initiated, piecemeal development, local governments should take charge of the planning process. General plans should designate where new growth, infill or redevelopment will be allowed to occur.
22. “Prior to any development, a specific plan should be prepared based on these planning principles.
23. “Plans should be developed through an open process and participants in the process should be provided visual models of all planning proposals.”

71. Livable Communities Initiative

(Federal Transit Administration, 1999)

a. Background

“Transportation options become more limited every day for those who lack access to an automobile, are unable to drive, or simply do not want to drive. Americans are now making more auto trips per day than ever before and the trips we are making are increasingly longer. In part, this phenomenon is due to the way we design our cities and suburbs. Regional shopping malls are surrounded and isolated by acres of paved parking, typically do not have transit service, and lack sidewalks to adjacent housing and to roadways where transit might be available. Further, other shopping, health care facilities, and social services tend to locate along highway arterials that likewise lack access for modes other

than autos. Such designs oriented only around the automobile, whether conscious or not, discourage access by bicyclists, pedestrians and transit users.

“However, design concepts are possible that can accommodate several transportation alternatives. Communities that are designed with a mix of employment, housing and shops nearby as well as within walking distance of transit stops can increase the number of trips made by mass transit, bicycles, and walking thereby decreasing single occupant auto trips. Resulting modal shifts can decrease congestion, reduce air and noise pollution, and improve the general mobility of our population.

“Permitting higher density development around transit stops can lower the cost per housing unit thereby increasing the supply of affordable housing. Further, the location of housing near transit can decrease the need for the second or third vehicle. One study finds that \$10,000 not spent on purchase of a car is equivalent to \$30,000 in housing.

“Adoption of proper design and land use guidelines and focusing development around transit stops can promote infilling and densification. Thus, the need to build over agricultural and natural lands is reduced thereby preserving more open space.

“Properly designed communities can also help citizens to not only be safer, but to feel safer. Many new communities are being built round wide arterials and a street network of cul de sacs. Such design causes many to drive rather than walk to their neighbors who might live just a few houses away. Lighted sidewalks along streets designed for slower speeds will encourage walking, transit and bicycle trips and attract daytime and evening neighborhood activity.

“The transportation planning process, in recent years, has involved greater numbers of people and interests. Still, too many transportation projects are still designed and built for the urbanized area or the larger community. Listening to the neighbors of a transportation facility and designing that facility so that it is consistent with the needs and desires of the people result in a more beneficial project that can encourage increased use of alternative transportation modes. Such a facility serves the neighborhood rather than just moving people through the area. Proper participation in the planning and design process can help give community identification rather than being a source of alienation.

“Livable communities represent a holistic approach to how cities are planned, designed and built. By paying proper attention to the involvement of people in the planning of neighborhoods, adopting appropriate planning

principles, and designing buildings, streets and other transportation facilities with people in mind, the livable communities initiative can be part of the solution to many problems facing us today.

“The economic downturn of the late 1980s and early 1990s slowed transit-oriented design and development. With the economy now on an upward trend and positive improvements in the real estate markets, local and State governments are now better able to encourage revitalization projects and new construction that adopt the principles of livable communities. Thus, the timing is appropriate for the Federal Transit Administration to launch a Livable Communities Initiative. The initiative is designed to encourage local and State governments to adopt the principles of livable communities in their transit planning and land use decisions.”

b. Description of the Livable Communities Initiative

(1) Purpose

“The Federal Transit Administration (FTA) has recognized the need for a new emphasis in its programs to make communities and neighborhoods move livable. To meet this need, the FTA is initiating technical assistance activities to help communities understand the principles of the Livable Communities Initiative and introduce more community-oriented transit facilities and services. Concurrently, FTA will emphasize the livable communities principles in the planning, formula and discretionary grants assistance programs. Special recognition will be accorded grantees who join together with community leaders to understand the linkages between transit and community needs.

“This initiative will demonstrate how transit facilities and services can be physically and functionally related to community needs when the community plans an active role in the local planning and design process for such facilities and services. Emphasis will be placed on improving access to community services and facilitating coordination of on-site community service like day care, health care, housing and commercial conveniences.”

(2) Objectives

“The objectives of the FTA Livable Communities Initiative are to improve mobility and the quality of life in communities by: 1) strengthening the link between transit and community planning, including land use policies and urban design standards which support the use of transit; 2) promoting increased participation by neighborhood and community organizations,

small and minority businesses, persons with disabilities and the elderly who currently participate in the planning and development process; 3) to increase access to or generate employment through high quality community-oriented transit services and facilities; and 4) serving, where appropriate, as the transportation component to the Department of Housing and Urban Development (HUD) and United States Department of Agriculture (USDA) Empowerment Zones and Enterprise Communities (EZ/EC) Program.”

(3) Characteristics of Livable Communities

“Transit is an important element in successful ‘Livable Communities.’ Characteristics of Livable Communities are as follows:

- **Well-Planned and Designed Transit:** Livable communities involve careful coordination of transit planning with community development planning. Livable communities are neighborhoods where housing, schools, and parks are within easy walking distance of user-friendly transit opportunities that effectively link residents with local social and economic services and jobs. In livable communities, transit service reflects the diverse needs of the community.
- **Transit, Pedestrian and Bicycle Access:** Land use planning, zoning and urban design encourage alternatives to automobile use. Such alternatives as walking, transit, and bike riding are designed and built into the community to ensure local mobility. In a livable community, use of the automobile is optional.
- **Mixed-Use Neighborhoods:** Residential areas are complemented by the presence of office and commercial areas, recreation areas, and areas devoted to health, educational and social service. Communities are planned and built on a human scale that emphasizes ease of access and community spirit. Businesses feel that they are part of a neighborhood. Transit facilities are designed to include space for day care centers, dry cleaners, and other enterprises that are useful to transit passengers.

- **Safe and Secure:** Streets are well lighted and designed to accommodate transit vehicles and pedestrians. Transit facilities and pedestrian walkways are designed to take into account the safety and security expectations of all passengers, including persons with disabilities. Traffic calming techniques are used to provide safety to pedestrians and lower traffic speeds.
- **Environmentally Conscious:** Well planned transit maximizes air quality. Parking is carefully managed to save space and to ensure that buildings are accessible to pedestrians and transit, and not isolated by large parking lots. Livable communities also contain sufficient parks and greenbelts to ensure a high quality of life for the residents.
- **Invite Full Community Participation in the Decision-Making Process:** Residents have a voice in the future of their neighborhoods. Livable communities are committed to a planning and management process that includes a high level of participation by neighborhood organizations, small and minority businesses, and individuals who may not otherwise be heard.”

(4) Eligible Recipients

“A special technical assistance activity is directed to a broad range of community organizations and other non-profit organizations in coordination with existing FTA grantees such as transit agencies, Metropolitan Planning Organizations (MPOs) and municipal, state and regional government bodies. These organizations are eligible for funding consideration through cooperative agreements for planning, research, training, and technical assistance projects.

“Grantees eligible for formula and discretionary grants are encouraged to incorporate livable communities principles in their plans and programs. Capital grants will be awarded to the public bodies and administered through the normal Section 5309 (formerly Section 3) grant process. Community organizations and other non-profit organizations may participate in the funding through third party contracts with public agencies and are encouraged to work with an eligible public agency when proposing Section 5309 projects. Entities proposing projects for funding consideration must demonstrate that the projects are transit related and promote the concept of a livable community.”

72. Walkable Communities: Twelve Steps for an Effective Program (Florida Department of Transportation, 1995)

“This document does not constitute a standard, but rather a guide for building our communities to give due consideration to pedestrians. Additional details are contained in the Florida Pedestrian Safety Plan, Transportation Research Board Report 294A and other documents. Please contact us for additional information.

“Pedestrian Preamble: This community, in providing for trip making, grants pedestrians and motorists of all ages and abilities rights, privileges, safety, mobility and access. To increase walkability, land use should feature clusters of homes, parks, schools, shops and employment centers within a ½ mile (1 k) radius of one another. Intersections should not favor either motorist or pedestrian, but give equal service and support to both. Landscaping, site design and land use patterns should reward those choosing to make a trip by foot, transit or bike. Public transit, with stops and stations linked with walkways, should be available to complement and extend walking trips.”

a. Provide Continuously Linked Walkways

“To accommodate people walking, and many with disabilities 5' (1.5 m) or greater width sidewalks or walkways with a separation from the roadway should be provided on both sides of all urban area roadways. A separation of 6 - 7' (1.8 -2.1 m) is recommended to meet proposed Americans with Disabilities Act Accessibility Guidelines (ADAAG). TRB 284A recommends 7' (2.1 m) with trees. In residential neighborhoods, there should be sidewalks along streets and walkway easements where appropriate. At least 36" (1 m) of the walkway should be clear of obstructions. Consideration should be given to clear sight distances. The walkway environment should include landscaping and streetscaping features such as shade trees and plantings, trash receptacles, street vending machines, utility poles, lighting fixtures, benches, transit stop shelters, directions to places of interest and kiosks. Codes and regulations as well as implementation and enforcement practices should promote street furniture placement so they do not impede or complicate movement for pedestrians. Wide walkways should be constructed in high pedestrian activity generator areas, such as retail centers, government buildings, other employment centers and transit stops and stations. Successful downtowns, beach frontages and entertainment districts often find a 50/50 ratio of walking space to vehicle space ideal for maximum economic development. Special care should be taken in designing and constructing walkways in campus environments.”

b. Pedestrianize Intersections

“To provide street crossings which accommodate the physical abilities of pedestrians, intersection design and mechanisms should be clear and understandable. The maximum crossing width should be 48' (14.4 m). Slip lanes, medians and bulbouts should be used effectively to reduce street crossing exposure, especially at complex intersections. Roadway geometry should dictate turning speeds of motorized vehicles to acceptable levels [below 20 mph (32 km/hr) on left turns, and below 10 mph (16 km/hr) on right turns]. Adequate sight triangles should be provided. Left turns should be minimized, if not eliminated, in downtowns and in other places of high volume pedestrian use. Pedestrian signalization, for a 3.5' (1 m) per second walking speed, should be provided.”

c. Americans with Disabilities Act (ADA)

“To aid in the independent mobility of people who cannot drive, special accommodations should be provided. References should be made to the ADAAG, Part 3 from the Architectural and Transportation Compliance Board. Two (2) curb ramps should be constructed on each street corner. One (1) curb ramp should be constructed at each side of marked mid-block crossings. Or, as an alternative treatment, the crosswalk area should be raised to curb height. When pedestrian demand signals are used independent call poles should be appropriately placed at the top of each ramp on all signalized intersections. All corners should have adequate sight triangles and sufficient depth for controller box, signal pole and other hardware to be located out of the walk zone. Audio/tactile pedestrian signal systems should be used in areas with large elder and disabled populations. Minimum walk speeds [3-3.5' (.9-1 m) per second], sidewalk cross slopes, grades, drainage inlets and minimum widths should be considered in constructing new and retrofitting existing walkways.”

d. Signal Placement

“To forewarn both pedestrians and motorists of the hazard potential of left turns into crosswalks, signals should be placed for optimum visibility during critical movements. Box span, mast arm, and corner pole signal placements should be used. Diagonal span signals should not be used because they cause motorists to look up rather than in front and to the side and pedestrians cannot see them at some intersections. Corner pole signals with left turn arrows are recommended to keep the driver focused on the pedestrian entry and travel path, especially in dense urban commercial areas and near schools. If appropriate at mid-block crossings,

controls should be placed on the median particularly where the ADAAG is relevant or large numbers of elderly pedestrians travel by foot.”

e. Illumination

“To provide clear visibility of pedestrians approaching intersection crosswalks at night, the approaches to and all street corners should be well illuminated. All intersection lighting should illuminate the crossing and waiting areas and/or create backlighting to make the pedestrian silhouette clearly visible on approach. All commercial, entertainment, school and other pedestrian traffic generating corridors and spaces should be well illuminated.”

f. Simplify Median Crossings

“To allow pedestrians to cross roads with a sense of safety, raised medians should be constructed to provide refuge (remember to cut medians at crossing for compliance ADAAG). Modern roads often have signalized intersections spaced 1320' (.4 k) apart. All current 5 and 7 lane cross sections should be retrofitted with raised medians. Landscaped medians should be built in existing as well as new roadways in tourist zones, entertainment districts, school zones, residential neighborhoods and other high volume pedestrian areas.”

g. Schools

“To provide safe access for children on their approaches to schools, school sites should have specific pedestrian access points. Roadway geometry should minimize travel speeds to 15-20 mph (24-32 km/hr). Slowing or calming vehicle traffic may be accomplished with raised crossings, traffic diverters, roundabouts, on-street parking and other land use and engineering designs. School sites should have pedestrian access points which do not require crossing points with vehicles. The approaches to all schools should have curb and gutter sections except in unusual circumstances. Streetscaping should assure maximum sight distance on all access, crossings and intersections. School zone designations for speed limits should be an element of a comprehensive ‘circulation’ plan which also includes crossing guard programs and identification of ‘safe routes’ for bicycling and walking to school.”

h. Eliminate Backing

“To eliminate the potential hazard of crashes occurring as motorists back out of parking spaces, site plans should minimize walking in vehicle spaces. Side lot, on-street and pocket parking should be included in

zoning regulations to eliminate opportunities for backing over walkways. To reduce conflicts between pedestrians and vehicles in parking areas, center walkways in landscaped areas, 'U' pattern dropoffs, and long throat driveways lined with sidewalks should be considered. Parking garages and lots should be given special design attention to protect pedestrians as they travel from automobiles to their destinations."

i. Access Management

"To provide safe pedestrian access to commercial developments, pedestrians should have access ways independent from vehicle access to all commerce. Left turns into unsignalized commercial access driveways should be minimized. Commercial developments should have shared driveways from main roads. Side street driveways should be at least 230' (70 m) from intersections. Commercial areas should have access ways into adjacent neighborhoods. Reduced building setback requirements should be used to encourage streetside window shopping and store front pedestrian street entries, with side lot and rear lot parking."

j. Auto-Restricted Zones (ARZs) and Parking Restricted Zones

"To protect pedestrians in busy commercial activity centers, vehicle traffic should be restricted to specific spaces or times of day/night. ARZs should be developed or managed in downtown transit and pedestrian corridors and malls, ocean walks, greenways, river corridors, and rails to trails conversions. Limited parking and true cost parking measures should be instituted in downtowns and other high traffic areas. Transportation Demand Management (TDM) programs should be considered to provide incentives for pedestrianization."

k. Combine Walking with Transit

"To increase travel distances for the pedestrian mode, access to and linkages with transit should be provided. One half mile (1 k) radius should be used for acceptable walking distances between trip origins and transit stops (5 to 10 minute walk). Transit should be convenient, inviting and efficient. As a general rule, bus stops should be at the 'far-side' of intersections so the bus does not become a visual obstruction for motorists and disembarking passengers trying to cross the street. All transit stops should be easy to reach by walkways, and be provided with shaded, visible, comfortable sitting/waiting space set back from the walkways. Planning and zoning should encourage development which enhances transit use and its access."

l. Walkable Scale Land Use Planning

“New and ‘in-fill’ land use development should favor walking over driving. Traditional Neighborhood Design (TND), grid, Planned Mixed Unit Development (PMUD) roadway systems, Transit Oriented Development (TOD) designs, neighborhood schools, pocket parks and neighborhood stores should predominate land use codes, ordinances and regulations. Places to sit should be provided on retail blocks and along corridors where people walk throughout their communities. Businesses should front on sidewalks with parking located alongside or behind stores. Shared use parking lots should be emphasized wherever possible.”

73. Effects of Site Design on Pedestrian Travel in Mixed-Use, Medium-Density Environments
(Moudon, et al., 1997)

“This project demonstrates that pedestrian volumes are related to site design. A quasi-experimental method was used to study 12 neighborhood sites with commercial centers in the Puget Sound region. The sites selected were controlled for four basic variables that previous research has identified as factors that affect pedestrian trip volumes. These variables were as follows:

- population density (the higher the density the larger the potential market of pedestrians)
- income (the higher the income, the easier the access to an automobile, which acts as a disincentive to walk)
- land-use type and mix (defining appropriate origin and destination of the pedestrian trip)
- a one-half-mile radius area within which all of the above variables are spatially contained (this distance, which defines an area of approximately 500 acres, is appropriate for pedestrian travel).”

The study found that:

- Population density, income, land-use distribution, and intensity “are, individually and together, insufficient to explain pedestrian volumes; site design, specifically block size and the extent of pedestrian facilities provided, must also be considered.
- “Contrary to popular belief, a substantial number of people walk to suburban centers...”
- Pedestrian volumes are not related to the size of neighborhood center

- “In this study, the combination of variables that described the distinction between urban (U) and suburban (S) site and pedestrian design characteristics was the best predictor of differences in pedestrian volumes.”
- “On average, the proportion of young people walking to all people walking was 180 percent higher than the proportion of young people in the census population living in suburban sites.”
- “A disproportionate number of people of Color was walking in both urban and suburban sites...”
- Most people walk on streets with sidewalks
- Most people walk along wide ‘main’ streets
- “The high incidence of jaywalking in suburban sites points to a major safety problem and indicates that pedestrians lack options in their walking routes.”
- Schools generate pedestrian traffic
- Apartments and grocery stores generate pedestrian traffic
- “[T]he relatively high population densities or densities of retail and office development all call for further research regarding the potential of these concentrations to support a balanced transportation policy.”
- “[L]and-use distribution and intensity in suburban sites are potentially as conducive to pedestrian travel as those in urban sites.”
- “[S]ite design and facilities are inefficient for pedestrians in suburban sites.”
- “Sidewalk systems in suburban sites were only one-fifth of the length of systems found in urban areas. Furthermore, sidewalks in suburban sites did not generally correspond to areas of concentrated residential or commercial activity.”
- “The mean distance between points where pedestrians could enter the commercial center was twice as long in suburban than in urban sites.”

“This study's findings show that it is imperative to address pedestrian safety issues and to improve the infrastructure supporting pedestrian

travel in suburban areas by providing appropriate facilities. Specifically, the following findings are significant:

- the comparatively high numbers of people walking in these areas
- the disproportionately high number of young pedestrians and pedestrians of Color
- the comparatively high numbers of pedestrians using streets with sidewalks in spite of the low incidence of such streets
- the high numbers of pedestrians jaywalking in spite of the dangerous conditions found on the wide, automobile-oriented streets found in suburban areas.

“The provision of additional pedestrian facilities in suburban areas also may increase pedestrian volumes and help reduce local auto congestion by encouraging people to substitute walk trips for auto trips. Because the vast majority of transit riders access public transportation by foot, developing appropriate pedestrian facilities is also relevant to supporting the use of public transportation.

“Our recommendations fall into two categories: the need to identify suburban areas where land uses already exhibit characteristics that are conducive to pedestrian travel, and the need to apply site design guidelines to support the development of safer and shorter pedestrian travel routes.”

74. Land Use/Transportation Scenario Testing (Replogle, 1993: Abstract)

“This paper discusses work by the Montgomery County, Maryland, Planning Department to use computerized transport models to examine alternative long-range development scenarios. Some scenarios envision continuing current patterns, policies, and trends, with a mix of automobile-oriented sprawled development and modest clustering around transit nodes, supported by transportation investments favoring roads and relatively weak levels of transportation demand management. Other scenarios examine the potential effects of clustering most new development approvals within walking distance of stations of an expanded rail network, with much greater pedestrian and bicycle friendliness in street and urban design, and significant changes in transportation pricing and employer commuter subsidies to favor alternatives to the automobile.

“Various combinations of input assumptions from different forecast years

and scenarios are used to help reveal some of the key factors influencing growth of automobile travel — land use patterns, infrastructure investments, transportation pricing, and urban design elements. Holding constant the transportation network while varying land use, and visa versa, provides some indications of the extent to which expanded transportation capacity may increase travel demand and the extent to which growing congestion may reduce demand. The analytic methods used in this research are discussed for their relevance to transportation-air quality conformity analysis and long-range comprehensive planning.

“These studies suggest that the pattern of development is more important than the pace or amount of development in determining the level of traffic congestion, energy use, and transport-related air quality. Even if the pace of growth was slowed dramatically, continuing the policies of the mid-1980s would lead to serious traffic congestion. However, alternative scenarios could accommodate doubling the amount of housing and employment with only modest growth in vehicle-miles of travel (VMT), producing acceptable levels of traffic congestion.”

75. Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions (JHK and Associates, 1995)

a. Introduction

“A goal of the California Air Resources Board (ARB) is to reduce emissions from motor vehicles in an effort to meet the State and Federal Clean Air Act requirements. One area of research that can be performed is the quantification of travel and emissions impacts of transportation-related land use strategies.

“The need to travel and the method of travel from an origin to a destination is influenced by land use patterns and the availability of transportation services. In this research project, transportation-related land use strategies have been identified that can be implemented to improve the efficiency and facilitate the use of transit, pedestrian, and other alternatives to single-occupant motor vehicles. As a result, these strategies would reduce, or slow the growth of, vehicle trips (VT), vehicle miles traveled (VMT) and pollutant emissions. The strategies examined in this study are intended to work in combination with other air quality programs designed to decrease reliance on driving, reduce vehicular emissions, and control of stationary sources of pollution. Transportation-related land use strategies are not expected to attain air quality standards by themselves, but they can be an important part of the effort to improve

air quality. Not included in this research project are strategies that are primarily transportation incentives and disincentives that do not include a land-use-related component. Examples of strategies not included in this study are: transportation demand management (TDM) strategies; small, incremental increases in transit service; increased gasoline costs or other pricing programs; and low or zero-emission vehicles.

“The places people travel, such as major shopping centers, universities, and employment centers (for example), are referred to as ‘indirect sources’ by air quality specialists because they attract vehicle travel. Numerous vehicle trips to and from such destinations produce emissions that can be quite significant when compared to pollutants emitted by typical stationary sources of air pollution, such as power plants, oil refineries, and manufacturing facilities. For this reason, the California Clean Air Act, adopted in 1988, required air districts to develop air quality attainment plans that include a provision to develop a program to reduce emissions related to such ‘indirect sources.’ However, State law prohibits air districts from infringing on existing local government land use authority in controlling indirect source emissions. (Cal. Health and Safety Code Section 40716(b)). The information contained in this report is advisory and intended to assist local governments in considering air quality criteria when making transportation and land use decisions. A primary goal of this project has been to provide information to local governments, air quality districts, developers, and other interested parties on how land use planning can be used in conjunction with transportation systems to help improve air quality. The specific objectives of the research project were as follows:

- Provide a comprehensive review of the literature and existing databases as they pertain to the relationships among land use, transportation and air quality.
- Identify transportation-related land use strategies that are effective, realistic, and implementable for a given situation (e.g., type of community, air quality problem).
- Define levels of performance goals for urban, suburban, and rural (exurban) communities that local government air quality districts and others can use in determining the appropriate performance goal for their situation.
- Recommend appropriate combinations of strategies that could assist in reaching the performance goals.
- Describe implementation mechanisms that can be used to implement

the transportation-related land use strategies identified within existing local government policy-making structures for land use decisions.

“The results from this project will provide a better understanding of the relationships among land use, transportation and air quality, and will aid the ARB and local air districts in working with communities in their efforts to help meet air quality attainment goals.”

b. Key Findings

“The most significant finding of this research study is that it is possible to develop recommendations for combinations of transportation-related land use strategies that are based on quantified data available from actual communities in California and that are applied separately to urban, suburban, and exurban communities. The recommended strategies are an example of ways that land use planning and development can be implemented in conjunction with transportation systems to reduce the amount of, or growth in, vehicle travel per household and resulting motor vehicle emissions. The availability of detailed travel and land use data for a sample of communities in California allowed the recommendations to have a quantitative basis. If data were made available for a larger number of communities in California, the strategy recommendations could be even further refined.

“Throughout this research study, a number of key findings emerged. The most significant of these are summarized below.”

(1) Literature Review

“Much of the literature on transportation-related land use strategies does not contain analyses of modeled or empirical data. A significant finding of this research study was the identification of those literature sources with the most complete and defensible quantification of impacts. Quantifiable effectiveness data obtained from the literature review was summarized in a matrix. Together with a detailed annotated bibliography, this format facilitated the use of the literature review in the development of the performance goals and strategy recommendations. It is difficult to quantify reductions in vehicle use and emissions from individual transportation-related land use strategies applied separately or on a site-specific basis, as opposed to community-wide. However, this study found that comprehensive packages of strategies, applied on a community-wide level, can be a fairly reliable method for achieving quantifiable reductions in emissions from vehicle use.”

(2) Case Study Community Data

“Communities located in California and outside of California were used as case studies for this research study. The California communities were examined to determine how travel and land use characteristics vary within the state. Travel and land use data from Portland, Oregon and some Canadian cities were examined to provide a basis of comparison for the characteristics found in California and to serve as a reasonableness check for our recommendations. These cities serve as potential models of improvement for California communities because they are similar in age and development patterns, yet they have maintained greater transit use and lower levels of household vehicle use. Suburban residents of Canadian cities average roughly half as much VMT per household as do suburban residents of the sample California communities. Summaries for each of the case study communities are provided in Chapter 4 of this report.”

(3) Holtzclaw Study

“A significant resource used for this research study was a detailed examination of travel data and transportation and land use characteristics from California communities conducted by John Holtzclaw. This study, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs*, was prepared for the Natural Resources Defense Council in June 1994. The data from this study provided the basis for developing the performance goals and defining specific characteristics related to the density, intensity, and mix of development needed to support a multimodal transportation system and reduce driving.”

(4) Performance Goals

“A significant achievement of this project was the identification of community-level performance goals related to vehicle use per household. The strategy for developing the goals is described in Chapter 5, and summarized in Table 1-1. Using primarily the data from the case studies, three ranges of performance goals for urban and suburban areas and two ranges of performance goals for exurban areas were specified. Based on its community type, a local jurisdiction could select a performance goal level that represents the amount of reduction in per-household vehicle travel and associated vehicle emissions desired from transportation-related land use strategies. The performance goals are described in more detail in Chapter 5, and a summary is provided in Table 1-2.”

c. Recommended Strategies

“After reviewing the literature, the case studies, and the Holtzclaw study, a list of recommended strategies was developed. Not all of the strategies

are recommended for each community type or performance goal level (as described in the strategy packages). Many of the elements of the recommended strategies already exist in a number of communities in California. A brief description of each of the recommended strategies is provided below.

“Provide Pedestrian Facilities. This strategy emphasizes pedestrian accessibility through the provision of convenient and direct pedestrian and bicycle facilities including sidewalks, crosswalks, and protection from fast vehicular traffic.

“Increase Density Near Transit Corridors. This strategy consists of efforts to intensify land uses within walking distance of a transit corridor or surface transit route. This strategy is typically characterized by new development, infill and redevelopment.

“Increase Density Near Transit Stations. This strategy encourages efforts to intensify land uses around existing or planned high-capacity transit stations (bus and/or rail). It includes new development, infill and redevelopment, and incorporates direct and convenient pedestrian linkages.

“Encourage Mixed-Use Development. This strategy encourages the location of compatible land uses within walking distance of each other. Mixed-use development typically results in a higher level of walking, as well as a greater potential for transit use, compared to single-use development.

“Encourage Infill and Densification. This strategy includes the infill, redevelopment and reuse of vacant and underutilized parcels within an already developed area. Implementation of this strategy tends to encourage walking and higher rates of transit use, and also increases the efficiency of transit systems.

“Develop Concentrated Activity Centers. This strategy clusters higher-density development appropriately into concentrated nodes to provide more convenient access to transit as well as increased opportunities for non-motorized travel.

“Strengthen Downtowns. Downtowns, also referred to as central business districts, are a special kind of Concentrated Activity Center. A strong downtown serves as a commercial, employment and cultural center which can encourage pedestrian travel within the area and also provides an important focal point for an area-wide transit system.

“Develop Interconnected Street Network. This strategy provides more direct routes for motor vehicles as well as pedestrians and bicycles. It reduces barriers created by wide arterial streets with fast-moving traffic and infrequent intersections while maintaining travel time for vehicles, even at somewhat lower speeds. Slower vehicular speeds help create a safer and more appealing environment for pedestrians and bicyclists.

“Provide Strategic Parking Facilities. It is possible to provide a lower amount of parking supply in areas with increased rates of transit use and walking/bicycling occurring as a result of the implementation of the strategies listed above. Less surface parking area reduces the distances between different land uses, which allows them to be more easily accessed by walking and transit use. Required parking supply should vary by land use type, proximity to transit service and accessibility to pedestrian and bicycle travel.”

d. Description of Strategy Packages

“As mentioned previously, one of the most significant findings of this study was that packages of transportation-related land use strategies for each of the community types may significantly reduce vehicle travel per household. For a local jurisdiction to determine which strategy package to pursue, the jurisdiction may identify its community type, determine current conditions, and select the performance goal that best meets its needs. The selection of a performance goal will be based on the amount of multimodal travel and air quality improvement desired for the community. The locality would then select an appropriate package of recommended strategies for the selected goal. Those strategies that have already been implemented in the jurisdiction can be determined and the remaining items would become the targeted strategies.

“The recommended strategy packages, including specific details on density, mixture of uses, and proximity to transit, are provided in Chapter 6 of this report. These recommendations were based on the Holtzclaw study, the literature review, information made available by the Building Industry Association on the building types feasible at various densities, and the expertise of the consultants, Advisory Committee Members, and ARB staff.”

e. Implementation Mechanisms

“The study developed guidance on available mechanisms for implementing the recommended strategies. Descriptions of the implementation mechanisms are provided in Chapter 7 of this report and are organized in the following topic areas:

- policies;
- policy documents;
- administrative actions;
- organizational tools;
- resource tools;
- problems/solutions; and
- monitoring methods.

“Some methods of implementing the recommended strategies are already available to communities through existing institutions and organizations. Examples of locations that have implemented these mechanisms are also provided. Table 1-3 indicates which of the implementation mechanisms are appropriate for each of the recommended strategies.”

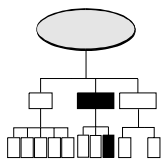
f. Future Research

“The JHK team, ARB staff, and Advisory Committee members have identified a number of areas, listed below, that would benefit from future research and study.

- Expand the number of case study communities (as in the Holtzclaw study) to add to the database.
- Collect data for exurban communities to serve as case studies.
- Implement demonstration projects for transportation-related land use strategies and track associated changes in travel behavior.
- Develop baseline data for local jurisdictions in California that

are comparable to the performance goals suggested in this report.

- Develop level-of-service standards for pedestrians, bicycles, and transit similar to those for intersections and streets.
- Evaluate the impact of traffic level-of-service standards on development densities.
- Perform additional analyses to further isolate the causality of a number of factors that influence travel behavior: density, lifestyle, income, availability of modes, attitudes, etc.
- Examine relationships between parking use, parking supply, parking costs, and parking requirements.
- Examine the relationship between quality of life characteristics such as crime, income, and density.
- Collect land-use-specific vehicle trip generation rates in California and evaluate how they are impacted by factors such as density, mixture of uses, location within metropolitan areas, and transit availability.”



C. CASE STUDIES

1. Case Study in Integrating Land Use and Transportation Decisions

(Capital District Transportation Committee, 1993: Overview)

“The home rule nature of land use decision-making in New York, the separation of regional transportation planning and regional land use planning into two agencies, and the requirement of consensus before WEST action, presents a challenge to those seeking to integrate land use and transportation planning, in New York. The size of the federal transportation program, and the collective responsibility of the MPO members in directing these funds represents a significant opportunity to foster integration of land use and transportation planning but the MPO must be engaged in these issues and members must be prepared to use MPO clout in encouraging linkages.

“A series of initiatives by CDTC has been relatively successful in meeting this challenge. While this effort must be considered a ‘work in progress’, the initiatives have had the cumulative effect of putting the land use transportation relationship on the table for discussion more often in the Capital District than in some other urban areas. These initiatives have

included ten sequential steps:

1. Adding suburban towns (on a rotating basis) to the MPO policy structure.
2. Shifting the focus of the long range regional plan from new highways to localized solutions to critical problems.
3. Assuming the lead role in traffic modeling.
4. Offering communities a lead role in addressing existing traffic problems and the traffic impacts of cumulative development through a shared-cost 'Cooperative Transportation Plan' concept.
5. Developing, a regional policy on public-private highway financing
6. Offering communities technical assistance in reviewing outline site impact studies and assessing traffic mitigation fees.
7. Establishing, Transportation Improvement Program (TIP) screening criteria which require land use management as a prerequisite to highway widening.
8. Assigning priority use of federal funds to implementing the projects and programs identified in the cooperative transportation plans.
9. Setting aside \$500,000 for a 'Corridor Management Initiative' to provide for land use planning, along, critical corridors to complement the cooperative transportation planning work.
10. Engaging town, county and city officials along with business leaders, freight providers, environmental advocates and the general public in a 'New Visions' initiative focussed on the next Generation of policy issues (those beyond 2000, using, a year 2015 horizon)."

2. The Impact of Various Land Use Strategies on Suburban Mobility

(Middlesex Somerset Mercer Regional Council, et al., 1992: Executive Summary)

"MSM Regional Council and its team of technical consultants have

completed an 18-month study on the interaction between suburban land use trends and regional traffic conditions. The results of the study verify what had previously been only a theoretical viewpoint: that concentrating new suburban development into higher density, mixed-use centers will slow the growth of regional vehicular use.

“The study tested the traffic impact of locating the region's new employees in Trenton and New Brunswick, as well as in tightly clustered suburban employment centers. Under scenarios proposed in the study, new residents would work and shop closer to their homes. Their living environment would be conducive to walking and reduced auto use. Those who still commute longer distances would have transit and ridesharing opportunities available to them, and a significant number would take advantage of these choices because of incentives provided by regional demand management policies. The study demonstrated that this approach to land use would create a significant reduction in the growth in traffic.”

a. Background

“MSM began this study in the summer of 1989 by reviewing the published data on the relationship between suburban development and transportation, as well as by evaluating various analytic tools for the study. A consultant team joined MSM in February 1990, and a steering committee and peer review panel comprised of transportation and land use professionals (listed in Acknowledgments) provided oversight for the project.”

(1) Constructs of Higher Density, Mixed-Use Centers

“The study team developed and tested three models — or ‘constructs’ — of higher density, mixed-use centers designed to fit within the suburban setting of the MSM region. These constructs incorporated residential and employment growth expected in the region by 2010 — a 30 percent increase in population (187,905 new residents) and a dramatic 54 percent increase in employment (182,581 new jobs) — but reshaped that growth into different land use configurations. The new growth was located in the cities and in a small number of newly created suburban centers instead of in low density developments spread throughout the region.

“Three construct types were used: a Transit Construct, a dense development that could house a minimum of 12,000 people and employ over 13,000, while maximizing transit, ridesharing and walking access; a Short Drive Construct, a somewhat less dense area of at least 6,700 residents and 9,500 employees, with ridesharing and walking as the main

travel alternatives to the single occupant vehicle (SOV); and a Walking Construct, a dense, pedestrian-oriented residential village of about 4,500 persons with only minimal service and retail employment opportunities.”

(2) Developing a Transportation Modeling Procedure

“A transportation modeling package called TransCAD was used for its capacity to incorporate important land use elements in a Geographical Information System (GIS). This allowed the project team to utilize transportation models similar to those used in prior regional studies (e.g., Route 1 Corridor Study, NJDOT, 1986) in combination with land use/demographic data bases and models that will have long-range applications for MSM, the counties, and the municipalities.

“A key part of the modeling process was to determine quantitatively how much less auto travel could be expected from the constructs. Using case study data, the study team determined that Transit Constructs would create 28 percent fewer vehicle trips than the same amount of development dispersed in less dense, single-use configurations. For Short Drive and Walking Constructs, the corresponding numbers were 24 percent and 18 percent fewer vehicle trips, respectively.”

b. Scenarios and Results

“Two scenarios were developed. Scenario 1 assumed that all new regional development between the year 1988 and 2010 would be distributed in two ways. First, much of it would be absorbed into suburban constructs located throughout the region. Second, a major resurgence of growth would, occur in Trenton and New Brunswick. In Scenario 2, no major resurgence of the region's cities was assumed. Instead, all growth would be absorbed into the suburban constructs, making them larger than those in Scenario 1.

The results for two key criteria are described and displayed in the discussion below.

(1) Vehicle Trips

The figure on the right examines the growth rate of vehicle trips occurring in the suburban portion of the MSM region between 1988 and 2010. Under ‘non-construct,’ trend conditions, new daily vehicle trips in the suburban area would be expected to grow by nearly 1.8 million. In Scenario 1, the combination of constructs and strong urban growth reduces that suburban growth to under 700,000 daily trips. In Scenario 2, where there is no significant new urban growth, new suburban vehicle

tripmaking still declines to about 1.2 million daily trips.

“When adding the large number of existing trips to these varying levels of new trip growth, the results for 2010 are as follows:

- There would be 18 percent fewer total daily suburban vehicle trips in Scenario 1, compared to the trend;
- and 10 percent fewer total daily suburban vehicle trips in Scenario 2, compared to trend.”

(2) Vehicle Miles Traveled

“As seen at right, the growth of new vehicle miles traveled (VMT) on the suburban regional highway network declines in the alternative scenarios. Under trend conditions, VMT grows by about 300,000 miles during the morning peak hour trip to work. Under Scenario 1, the growth of AM peak hour VMT is under 170,000 miles. In Scenario 2, the growth is slightly more than 200,000 miles.

“When the existing VMT are added to these varying levels of new VMT growth, the results are as follows:

- In the year 2010, there would be 12 percent less total VMT in the morning peak under Scenario 1, compared to the trend;
- and 9 percent less total VMT in Scenario 2, compared to the trend.

“In addition, a peer review process was built into the study at two important junctures of the project. First, on May 14-15, 1990, a meeting was held between the project team and a peer review panel. At this meeting, the overall methodological direction of the study was discussed, highlighting the following key issues (discussed in detail later in this report):

- The TransCAD software used for modeling transportation impacts;
- The ‘constructs’ and ‘scenario’ approach for testing land use patterns;
- Site planning to reduce vehicular use; and
- Travel demand management policies and effectiveness.

“At the second juncture - during November and December of 1990 -- a key interim document describing the capabilities of constructs to reduce

single occupant auto tripmaking was circulated for comment among peer reviewers (Appendix A).

“The comments of the peer review panel, as well as steering committee members, were a valuable resource to the project team during the course of the study.”

c. Study Process

“The study consisted of five major tasks, which are briefly described below and described in more detail later in this report.”

(1) Suburban Mixed-Use Centers and Transportation: Current Research

“To test the hypothesis that concentrating growth in mixed-use centers would yield regional transportation benefits, the project team began by exploring published research for evidence of interaction between land use and transportation in general, and more specifically, the travel behavior associated with different facets of existing suburban mixed-use centers. Documented parameters for mixed-use centers, such as proper density, scale, design and mix of activities, were gathered as an empirical foundation for the analysis.

“In addition, effective demand management techniques were examined to determine the extent to which the benefits of changing land use might be enhanced by implementing transportation management programs (a reciprocal enhancement was expected). Although the literature search did not uncover any hard and fast rules, a number of case studies emerged which served as the basis for crafting the prototype mixed-use centers.”

(2) Building Basic Constructs of Mixed-Use Centers

“The theoretical concept of a higher density, mixed-use center was formalized into a set of land use models, or ‘constructs.’ These constructs were meant to be ambitious, yet realistic representations of suburban centers which include good planning and design features, especially a pedestrian environment while meeting the region's needs for residential and employment growth.

“Three types of constructs were formulated:

- The Transit Construct: A high density, mixed-use center with a high concentration of employment. It is designed to maximize the use of

transit services and provide significant pedestrian amenities.

- The Short-Drive Construct: A high density, mixed-use center, somewhat lower in density than the transit construct, but also with a high concentration of employment. Although there are minimal transit services, there are significant pedestrian amenities in this construct as well.
- The Walking Construct: A tightly clustered, mixed-use village or town, with a high level of residential development and only minimal employment opportunities.”

(3) Modeling the New Land Use/Transportation Relationships

“A regional transportation model was developed for the purpose of testing the effects of the constructs on travel in the MSM region. The typical modeling system has four steps: 1.) trip generation: uses formulas to generate total trips; 2) distribution: distributes trips throughout the region; 3) mode split: defines the proportion of trips using different forms of transportation; and 4) assignment: it assigns vehicle trips to appropriate routes for traveling from place to place.

“The modeling system used in this study is the TransCAD software package which combines a geographic information system (GIS) with a traditional four-step transportation planning model. This GIS capability has a number of benefits. It provides numerous procedures for processing land use data, constructing and subdividing traffic zones, calculating the precise location and adjustment of transportation network links, and summarizing traffic characteristics by geographic area. It is also capable of storing present and future land use and demographic data at the parcel, census block and municipality level, a feature which is attractive to the long-term planning efforts of MSM.

“The modeling system was further adjusted by consideration of some key tripmaking characteristics of the constructs, as distinct from the other subareas of the region. For the region as a whole, auto trip generation rates were developed using formulas developed by previous NJDOT studies in and around the MSM region. But these rates were adjusted for the different construct types — based on case studies and the team's planning judgment to develop ‘trip reduction factors’ — to reflect the enhancing effect of density, demand management, mixed uses and transit services on reducing regional auto use to and from these constructs.”

(4) Forecasting Development Scenarios

“A 1988 baseline of employment and population conditions in the MSM region was established. A forecast year of 2010 was selected for evaluation and a ‘2010 Trend Scenario’ was developed, projecting conditions similar to those in the base year to the year 2010. These forecasts represent the trend of what is likely to occur in land use and transportation conditions without any change in policy direction.

“In addition, two alternative land use scenarios were developed for the year 2010 to compare with the trend:

“Scenario 1: a combination of suburban development in constructs and increased employment and population growth in the region's major cities;

“Scenario 2: the replacement of all trend suburban development with development in suburban constructs, and only trend growth in the cities.

“The two scenarios differ by the amount of growth which is allocated to urban vs. suburban areas.”

(5) Analyzing the Transportation Impacts of Construct Scenarios

“The impact of construct vs. trend development was analyzed, focusing on four key indices of transportation conditions at the regional and subregional level:

- The number of vehicle trips;
- The level of vehicle miles traveled (VMT);
- The level of delay experienced; and
- The average speed.

“These measures were then assessed in aggregate terms — what happens in the suburban portion of the region overall — and in disaggregate terms, for their effects on suburban municipalities.”

3. The Route 1 Corridor in Danvers: A Land-Use Study (Metropolitan Area Planning Council, 1981)

“In May of 1980, the town of Danvers requested the Metropolitan Area Planning Council (MAPC) to conduct a land-use study of the area in their town surrounding Route 1. A local task force was organized with representation from businessmen and property owners in the Route 1 area and from the town's Planning Board, Board of Appeals, and Conservation Commission. Community Development and Engineering Division staffers and the town manager were also involved.

“For several years, businesses in the area were oriented to Route 1, the major north/south highway. What happened was that during the '70s, Interstate 95, a limited-access highway, was constructed roughly parallel to Route 1. South of Peabody, one highway is designated as both Route 1 and I-95. In Peabody, I-95 becomes a separate highway from Route 1. Interstate 95 then closely parallels Route 1 to the east through most of Danvers and crosses it just south of the Topsfield line, continuing north on the western side of Route 1. After I-95 was completed, in 1977, traffic patterns were altered, and the traffic volumes on Route 1 were reduced by nearly one-half. The existing businesses were affected by the decrease in traffic, of course, and the new interstate highway created development pressures in the corridor. The charge to MAPC was to help resolve these issues in the way most beneficial to the town. Recommendations for zoning amendments, to be adopted by the town meeting, and other land-use policies to affect development in the corridor were expected as results of the study.

“The task force specifically identified the following problems in the study area:

- Interstate 95's acting as a bypass, diverting traffic and therefore business patrons from Route 1;
- Inadequate signage alerting motorists to services available on Route 1;
- Inadequate directional signage on the highway interchanges;
- Too-permissive zoning;
- Underutilized property; and a
- Lack of buffers and screening between residential and non-residential uses.

“The highway network in and around Danvers has had a large impact on land-development patterns. In 1964, approximately 77 acres of commercial land, including Danvers Plaza, abutted Route 1. However, soon the North Shore Shopping Center, on Route 128, and other regional commercial centers began to offer heavy competition. As noted, Route 1 was the dominant north/south highway from its construction, in 1803, until the completion of Interstate 95, in 1977. Interstate 95 is the easternmost of the system of 90 percent federally funded, limited-access expressways constructed across the country. After its completion, existing businesses, many of them tourist- or auto-related, were hit hard by the drop in traffic. Not only did the construction of I-95 alter business and traffic patterns, but the new highway created an odd-shaped strip of land to the east of Route 1. This land between the two highways varies from approximately 1,500 feet to 100 feet in width.

“Even though the construction of I-95 has caused some local problems, it has also enhanced the area for development. Access to Boston and major highway routes is excellent, which makes the market for development extremely strong. And industrial and office developers are attracted not just by this access but by the high visibility of the property from the highways.

“Another attractive aspect of the corridor is the presence of the Danvers State Hospital grounds, a beautiful piece of property, with structures dating from 1878. In the context of this study, the hospital is important because of the current plans of the state Department of Mental Health (DMH) to phase out its use of the site. The potential of this site is one-of the key elements in any plans for the corridor.

“The Route 1 Task Force was created to study the problems identified in the Route 1 corridor and to develop recommendations for solving the problems. The Metropolitan Area Planning Council presents this report as an aid to the task force. The recommendations contained in this report are those of the Council, not the task force. It is recommended that the task force continue to meet to discuss these recommendations and, with the help of the town's Community Development Division staff, prepare the necessary zoning amendments. The proposed amendments should then be reviewed by the Planning Board and presented for consideration by the town meeting.

“Summary of Recommendations:

1. A zoning district should be created specifically for the highway corridor. The purpose of this zoning district is to provide for

large-scale development and creative site planning. An important element of the proposed regulations is the provision of a 100-foot buffer between residential and non-residential areas.

2. A zoning district should be created for the entire Danvers State Hospital site. This district should allow for both new construction and the rehabilitation of existing structures. A variety of uses should be allowed on the site, and major considerations should be screening between uses, retaining open spaces, internal circulation, and the impacts of increased traffic in the area.
3. The town should adopt provisions for site-plan review by the Planning Board. It is recommended that any development in the highway-corridor district involving 10,000 square feet or more require site-plan review. Any development or redevelopment on the state-hospital property must have site-plan review.
4. Regulations governing the number, type, size, and placement of signs within the highway-corridor district should be adopted by the town. The ' bylaw should specifically prohibit billboards.
5. The town should carefully evaluate the effects on traffic of any proposed development in the corridor, especially any reuse of the state-hospital property. Part of the required information for site-plan review for any major development proposal should be information concerning the anticipated volume of traffic to be generated.
6. The town should be prepared to seek traffic analyses and, possibly, subsequent engineering work from the state Department of Public Works in the event that development generates traffic volumes in excess of the capacity of existing interchanges.
7. The Route 1 Task Force, which was created at the beginning of this project, should continue to meet. There is still work to be done in the corridor, and the Task Force is a very good working group to discuss issues as they arise and to help formulate the specific zoning amendments based on the recommendations of this report."

4. Transportation and Land Use

(Wisconsin Department of Transportation, 1993: Introduction)

a. Why is WISDOT Interested in Land Use

“Land use decisions and transportation investments are closely interrelated. Each affects and is affected by the other. Decisions about land use and development determine the transportation needs of an area — both in terms of trips to and from the area and the transportation modes that can be used to make those trips. Thus, land use decisions and transportation investments affect the level of mobility in the region, the viability of each transportation mode in the region, and the overall efficiency of the region's transportation facilities and services. In addition, transportation investments can have impacts — at the regional, community, and site-specific level — on land uses.

“In a well integrated system of land use decisions and transportation investments, the trips generated by development can be efficiently served by the transportation system provided. However, where land use decisions and transportation facilities and services are not considered together, a variety of problems may occur. The travel demand generated by development in an area may exceed the transportation system's capacity; land development patterns and building site designs may make travel in an area difficult by multiple modes of transportation; and transportation investment decisions may accelerate development in an area that might not otherwise have developed in the same way or at the same pace.

“The Wisconsin Department of Transportation (WisDOT) is interested in improving the integration of land use decisions and transportation investments in order to fulfill its mission of providing an accessible, safe, efficient, multimodal transportation system for Wisconsin.”

b. WISDOT's Exploration of Land Use and Transportation Issues

“This paper is part of WisDOT's current multimodal planning process — TRANSLINKS 21. Its purpose is to discuss specific facets of the land use-transportation relationship in order to stimulate thought about alternative roles that WisDOT might play to make the relationship between transportation and land use a mutually beneficial one for Wisconsin. The paper provides background information about interactions between transportation and land use, describes WisDOT's interest in these issues, and then describes a range of alternative departmental policies for WisDOT to consider.

“To better understand the broad and complex relationships between transportation and land use, the issues in this paper have been divided into four policy areas. The first two policy areas address the interactions between transportation planning and land use planning. Therefore, they discuss processes that could be used to improve the coordination between transportation planning and land use planning. The third and fourth policy areas address the physical interactions between transportation and land use.

“The first process policy area, described in Chapter III, examines the need to improve the coordination between the different levels of government who plan for the same geographic area. It presents and reviews alternative answers to the question:

“What approach should WisDOT take to improve the coordination between state and regional transportation planning and local land use planning?

“In Chapter IV, the second process policy area considers the relationships between planning for adequate transportation investments and the land development decisions of local governments. It considers the difficulties of planning for adequate transportation facilities and services when land development takes place that is not consistent with local land use plans or in the absence of land use plans. Since transportation investments may influence when and how land develops, this policy area presents and reviews different answers the question:

“What role should WisDOT play in facilitating local land use plan implementation?

“The last two policy areas address the physical interactions between transportation and land use. The first physical policy area, discussed in Chapter V, concentrates on the relationships between land use patterns and the different modes of transportation. It describes the elements of an urban form that supports automobile, transit, bicycle, and pedestrian travel and then presents and reviews alternative answers to the question:

“What should WisDOTs role be in achieving urban forms that support all modes of transportation?

“In Chapter VI, the final physical policy area examines how transportation investments and land uses interact at the site-specific level. It observes that since transportation facilities and land uses are located adjacent to each other, what happens on one has a direct impact on the other. It presents and reviews different answers to the question:

“What sort of neighbor should WisDOT investments be and what sort of neighbor should WisDOT expect adjacent land uses to be?”

“Chapters III through VI provide background on each policy area, present a range of alternative WisDOT policies, and review the policies in relation to TRANSLINKS 21 goals, values, and additional descriptive factors. Chapter VII discusses how the four policy areas and their respective policy alternatives interrelate and presents examples of policy alternative packages.

“As part of its TRANSLINKS 21 planning process, WisDOT is seeking significant public input on the policy alternatives presented in this paper and welcomes comments on the ideas expressed in the document. Readers are encouraged to comment on the general issues raised, to offer support or concerns about the various policy alternatives, and to contribute additional policy alternatives. The 16 policy alternatives presented in this paper are meant to be the beginning of the discussion, not the end. Comments on the paper should be directed to the person listed on the back of this report.”

5. Chicago FTA/FHWA Enhanced Planning Review (Lyons, 1996h)

a. Development of the Regional Transportation Plan

“The TSD Plan update states that the goals and objectives are intended to serve as guidelines against which projects can be reviewed to determine whether they meet regional and local needs. The current goals and objectives are as follows (with revisions to the original plan noted with an asterisk):

- “4. Goal: Develop a transportation system which minimizes undesirable environmental impacts.
- Promote long term improvements in air quality.
 - Develop a transportation system that uses energy efficiently and is adaptable in response to possible energy shortages.
 - Protect environmentally sensitive lands.
 - Encourage the preservation of prime agricultural lands consistent with local land use patterns.

Land Use Planning ■

- Protect waterways from pollution and excessive runoff.
- Minimize the noise and vibration levels of the transportation system.
- Promote visually pleasing facilities.

“7. Goal: Encourage land use planning and demand management techniques that achieve mutually supportive and efficient patterns of land development and transportation service.*

- Develop transportation strategies that discourage further metropolitan decentralization that is inconsistent with the Strategic Plan for Land Resource Management as reflected in the adopted regional growth forecasts.*
- Increase transit use by encouraging intensive developments to locate within easy access to existing or planned mass transit service.
- Reduce congestion in the vicinity of expressway interchanges through local planning and zoning policies that promote development compatible with the interchange function.
- Coordinate transportation plans with the provision of utilities and municipal services to reflect adopted regional forecasts and municipal, county and regional plans.
- Promote intergovernmental cooperation in the coordination of land use and transportation developments.
- Promote transit-accessible site design in major land developments.
- Promote site designs which minimize the adverse impacts of site access on the transportation system.
- Minimize peak hour auto work trips by land use planning and demand management techniques.
- Encourage local governments to limit development to levels compatible with transportation service.

- Promote dedication or reservation of adequate transportation rights-of-way in the land development process.

“The update of socioeconomic/land use forecasts and travel demand models used in the 2020 RTP will be based on the 1990 Census data and the CATS Household Travel Survey conducted between 1989 and 1991. The first step in the forecasting process was completed in March of 1994 when NIPC endorsed new regional forecasts which were accepted by CATS and its member agencies. These forecasts project significant growth between the 1990 base year and the 2020 horizon year including a 25% increase in population, a 37% growth in employment, and a 31% growth in the number of households. The next step in this process, which is currently under way, will be to determine the distribution of people, jobs, and households throughout the region.

“In April of 1996, NIPC was expected to deliver three scenarios to CATS for use in their sketch models to evaluate alternative transportation investments. The three scenarios include a continuation of the trend towards decentralization, redevelopment of the urban core areas, and a potential third airport in a south suburban location. Each of these scenarios will be evaluated using two alternative transportation networks resulting in six alternatives to evaluate using CATS sketch models. After November 1996, CATS will recommend a single preferred draft transportation network and NIPC will prepare a single forecast file which will be available for public review and comment before adoption of the 2020 RTP.

“Projections for rapid growth pose a major challenge for CATS and the transportation planning community in the Chicago metropolitan area, particularly in light of financial resource constraints. The current TSD Plan update for 2010 which was adopted in March of 1994 projected financial needs of approximately \$25.9 billion for highway and transit system components through 2010, but only \$19.2 billion in available resources to address those needs. These resources are not sufficient to cover the \$20.5 billion identified solely for capital maintenance which includes major reconstruction of existing systems, aside from the \$5.4 billion identified for major facility expansions, other expansions, and right-of-way preservation. These funding deficiencies were based on prior forecasts of population and employment which were significantly lower than the new forecasts described earlier.”

*b. FHWA and FTA Administrators' Focal Points: ISTE
Fifteen Factors - Consistency with and Impact on Land Use
Plans*

“Recommendations from the NIPC's Strategic Plan for Land Resource Management are incorporated into the 2010 TSD Plan. Socioeconomic forecasts used to estimate future travel are based upon the region's adopted land use plan.”

c. Travel Demand Forecasting

“CATS administers the transportation demand forecast model Urban Transportation Planning System (UTPS) for transportation planning and air quality analysis purposes. In response to conformity issues, CATS agreed to a set of modeling enhancements at a consultation meeting with local, state, and federal officials in October of 1994. The October 1994 agreement called for CATS to use the enhanced models for all future program and plan conformity work. Specifically, CATS agreed to implement the following five enhancements: use empirical speeds derived from a travel-time study, model peak and off-peak travel demand, iterate the full travel demand model set to stability, sensitize the trip generation model to travel options and accessibility, and demonstrate the relationship between the transportation system and land use forecasts.

“While development work on these enhancements has been completed, implementation of enhancements to the production phase has been delayed; a completion date is still to be determined. According to CATS modeling staff, current delays are of a data processing nature primarily related to difficulties integrating existing and enhanced modeling components and transitioning from a main-frame to an EMME/2 work station platform. Furthermore, CATS modeling staff reported that the enhancements were delayed due to conflicting staff priorities including special project analyses and difficulties encountered with the implementation of NIPC's Disaggregated Residential Allocation Model/ Employment Allocation (DRAM/EMPAL).

“DRAM/EMPAL has been identified as an important component of the 2020 RTP development process. DRAM/EMPAL has the potential to provide local agencies the ability to analyze relationships between land use and transportation scenarios and their impact on policy measures such as urban redevelopment, suburban sprawl, transit use, air quality, and travel demand. Despite ongoing delays due to problems encountered with calibrating the model to reflect the metropolitan area, CATS and NIPC staff assert that they are committed to developing the model as an effective planning tool. Upon completion of the baseline scenarios using

DRAM/EMPAL and the CATS sketch models based on NIPC's March 1994 regional demographic forecasts, a decision concerning the future use of DRAM/EMPAL in the planning process will be made.

“A number of representatives from CATS member agencies expressed concern regarding the coordination and integration of the CATS transportation model, DRAM/EMPAL, and other implementing agency's models. While agencies or jurisdictions such as the RTA and Metra may have their own models for the purpose of project level analysis and are moving ahead with separate efforts for model improvements, staff from all agencies emphasized a desire to ensure the consistency of the transportation networks, model assumptions, and data. Toward that end, all agencies utilize the NIPC demographic figures as baselines for their models, while local jurisdictions typically make use of trip tables from the CATS regional model. CATS' technical staff expressed the hope that in the long term their regional model would serve as a resource to all member agencies and would complement each agency's on-going technical program.”

Observations and Observations

- “1. CATS Modeling Enhancements: There has been significant progress in implementing the CATS modeling enhancements identified in the October 1994 federal consultation meeting. However, delays in completion of model updates continue to limit CATS' ability to address metropolitan planning and air quality conformity requirements in a timely manner. In order to meet its commitments, the CATS Policy Committee should ensure that completion of modeling enhancements is a top priority.
- “2. Integration of Land Use and Travel Demand Modeling Efforts: Work is currently under way by NIPC to integrate the recently implemented DRAM/EMPAL land use models with the CATS transportation demand model. At present, outputs from the land use models are used as input to the transportation planning process. Future efforts to enhance the integration of land use and transportation models will improve CATS' capacity to perform sensitivity analyses based on alternative transportation/land use scenarios. This is particularly important for developing an updated plan that will guide regional decisions.
- “3. Inter-Agency Modeling Coordination: CATS should work with all participating agencies to develop a process to ensure consistency and coordination of modeling efforts. This could reduce overlapping agency activities and enhance technical coordination through the

assignment of lead responsibility for integration of model components such as the transit network with the RTA and CATS models.”

6. Dallas FTA/FHWA Enhanced Planning Review
(Lyons, 1996i)

a. Development of the Regional Transportation Plan

“Although the MPO's planning efforts are based on regional growth and development assumptions and forecasts created by a division of NCTCOG, the MPO does not include discussions of them in its planning documents. By not including this level of detail, the MPO loses an opportunity to discuss the links between regional growth and development, land use, and transportation. These are potentially controversial subjects since the region is growing rapidly, and its jurisdictions compete for economic development resources.”

b. Travel Demand Forecasting

“The MPO's modeling capabilities represent a very advanced state-of-the-practice in travel forecasting. In some instances, the MPO is pushing the state-of-the-art. Specific comments on the modeling process follow:

“Land Use - The DRAM and EMPAL models are used for the basic land use forecasts. These models forecast land use to 191 sub-zones, with other procedures to suballocate to 8000 zones. In the allocation to 8000 zones, planners' judgment can alter the forecast. However, the 191 zone forecast of DRAM and EMPAL remains fixed.

“Feedback - Feedback occurs between the assignment and distribution steps and from assignment to land use. The distribution process begins with a congested network. After assignment, one initial feedback is made to distribution and a second assignment made. If there are significant changes between the first and second iterations, further runs are made. To date, nearly all analysis has required only one feedback loop.

“The DRAM and EMPAL models are used to forecast population and employment developed in five- year increments. Staged transportation networks consistent with the air quality conformity process are used as accessibility measures. DRAM/EMPAL provides an initial base year forecast of land use. Base year travel times are in part developed from this process. The travel times are fed back to DRAM and EMPAL to determine allocation changes. In each succeeding time period, a revised transportation system reflecting programmed improvements (both highway

and transit) is used to calculate zone to zone travel time between each of the 191 zones. The updated travel times resulting from highway and transit assignment are then provided as input to the DRAM and EMPAL runs for the next time period. Final transportation plan networks are used to compare zone to zone travel times before and after the demographic forecasts to insure equilibrium.”

7. Honolulu FTA/FHWA Enhanced Planning Review
(Lyons, 1996a)

a. The Honolulu, Hawaii Metropolitan Area: Projections and Forecasts

“The State and City can have a significant role in directing development. The State designates land use as Conservation, Agricultural, or Urban and has control over changing land use designation from Conservation or Agricultural to Urban. The City is responsible for zoning land designated as Urban by the State and for adopting land use and development plans. The City is in the process of adopting Development Plans for Honolulu's eight major geographic regions. These plans, if adopted by the City Council, would have a significant effect on future land use patterns. High levels of job growth are forecast for Central Oahu, Koolauloa, Waianae, East Honolulu, and Ewa.

“While population and employment opportunities are forecasted to continue to grow, new land use policies and development plans being considered by the City and State would change were this growth is expected to occur. Honolulu's Central Business District (CBD), the financial, retail and industrial area between Pearl Harbor and Waikiki, is forecast to experience low growth rates in jobs and population. The CBD is still expected to contain 67% of Oahu's jobs in 2005.

“One of several land use scenarios currently being considered by the City is the Dual Town Center scenario. This assumes that total growth, in both absolute and relative terms, will be greatest in a "Second City" in the Ewa area. The Ewa area is located to the west of Pearl Harbor on the south side Oahu. In 1985 Ewa had low levels of jobs (10,900) and residents (37,000). If the land use policies and development plans assumed by the Dual Town Center scenario are adopted, Ewa's population is projected to grow by 51,000 and employment is projected to increase by 40,000 by 2005.

“The Honolulu area experiences significant congestion problems which will only be partially relieved by the movement of growth from the CBD to the Ewa area. This move would reduce commuter demand to and from

the CBD, but would not address all of the area's congestion problems. The Ewa Development Plan was incorporated into the 2005 Plan in 1993. Development Plans approved by the City will be included in the next Regional Transportation Plan, the 2020 Plan, which is expected to be adopted in 1995.”

*b. Organization and Management of the Planning Process:
Metropolitan Planning Organization Designation and
Membership*

“The TAC includes the Directors of the HDOT, OSP, DBEDT, DTS, PD and HPTA. These agencies are responsible for the region's land use and transportation planning, and transit management activities.

“Much of the planning work in the metropolitan area is done at the State and City level. The OSP and PD have responsibilities for land use and other planning activities. The State and City Transportation Departments have Planning Divisions, and planning is also done by the various divisions of HDOT and by HPTA. ISTEA has increased the work load on the MPO and agency staffs. This is occurring at a particularly difficult time because both the State and the City are facing budget deficits and are looking for opportunities to cut staff and other costs.”

c. Development of the Regional Transportation Plan

“The development of the ORTP is closely linked to local land use and other local planning activities. A land use planning process is underway concurrent to the development of a new ORTP. The transportation scenarios and assumptions considered in the development of the ORTP are also being used in the development of the regional land use plan, and land use scenarios and assumptions being evaluated in the development of the land use plan are being considered in the development of the ORTP.

“The land use planning effort considered five land use scenarios. The scenarios that offered the most extreme difference, the Base Case scenario, which assumes there will be no change in development patterns, and the Second Urban Center scenario, which assumes that a second urban center will be developed in the Honolulu's Ewa district, were used in the early stages of the development of the ORTP. The scenarios were used to consider the transportation impacts of the land use scenarios that were most different. The final ORTP will assume the Base Case scenario. Both the land use and the transportation planning processes assume that the proposed, but not funded, HRTTP will be completed.

“The ORTP is being developed through a cooperative process between the MPO, the State and the City. Most of the technical work is being done by a consultant to OMPO with the assistance of staff from State and City agencies and the transit operator. OMPO's role in this process has been to oversee the work of consultants, to collect and review work done by State and City agencies, including the transit operator, to identify areas where activities conflict or are redundant, and to manage the flow of information among involved parties. OMPO has also been responsible for setting up public meetings throughout the development of the ORTP. These meetings have given the public the opportunity to have a voice in the process at each step of the development of the ORTP.”

d. FHWA and FTA Administrators' Focal Points: Financial Planning and Financial Constraint

“Financial constraint in the ORTP is made difficult by the need to have a regional transportation plan that reflects regional land use planning decisions. All the regional land use planning scenarios being developed by the City assume that the H RTP will be built. This project has no committed funding source or financial plan. Without a funding plan that includes both expected sources of funds and a description of how these funds will be made available, inclusion of the proposed H RTP in the ORTP will result in an ORTP that is not financially constrained. Both transportation and land use planning assumptions should reflect that the H RTP has no committed source of funds; transportation and land use scenarios that do not include this project should be considered.

Observations and Recommendations

- “3. Constrained ORTP: All regional land use scenarios assume a H RTP will be built. Without a funding source, inclusion of a proposed H RTP in the ORTP will result in a financially unconstrained ORTP. Both transportation and land use planning assumptions would appear to be incomplete if a H RTP financial plans are not established; other transportation scenarios that do not include this project may need to be considered. The ORTP should include a financial plan describing how a H RTP will be funded, including funding strategies and available resources.”

e. Travel Demand Forecasting

“The present model bases person-trip generation on socioeconomic and land use forecasts, including detailed forecasts for special generators, such as large military bases and Honolulu International Airport. Land use and socioeconomic projections are converted into person-trips classified

into six different trip-purpose categories. This linkage suggest that any improvements to the travel demand forecasting model need to be accompanied by an on-going parallel effort to improve the land use model.

“The land use forecasts, which serve as a foundation for trip generation, are developed at a high level of detail and appear to be the product of substantial effort. Assessment of the validity of these data would be facilitated by better documentation of the technical methods used in projecting future development patterns.”

f. Conclusion

“As reflected in the observations throughout this report, the federal team identified several areas where the MPO and the participating agencies in the local transportation planning process appear to have successfully implemented comprehensive and coordinated planning practices. In particular, these include the following areas:

- Improvements to the modeling and forecasting process.
- Changes to the public involvement process.
- Linkages between land use and transportation planning.”

8. Miami FTA/FHWA Enhanced Planning Review (Lyons, 1996e)

a. Organization and Management of the Planning Process: Institutional Relationships

“Metro-Dade MPO's full time staff of 18 is augmented by staff from participating agencies as well as consultants in developing the products of the planning process. This staff approach is reflected in the MPO's direct budget of \$1.9 million of which approximately 32% is for other agency support and 21% is for consulting services. Personnel from participating agencies are assigned to perform specific MPO duties as needs arise. Each agency participating in the planning process is responsible for specific elements as outlined in the Prospectus and summarized below:

- Dade Planning Department: As the areawide comprehensive planning agency, the department reviews the LRTP for consistency with the CDMP and other plans, collects and develops land use and socioeconomic data for input into travel demand forecasts, and determines environmental impacts of proposed transportation projects.”

b. Development of the Transportation Improvement Program

“According to information in the TIP, transportation and land use coordination activities are ongoing and include standard consistency checks with the CDMP and analysis and verification of traffic impacts. Exclusion of a project or facility from the CDMP could prevent Dade County’s participation in the project even if it is included in the LRTP. Therefore, it may be necessary to amend the CDMP to implement proposals in the LRTP.”

c. Development of the Unified Planning Work Program

“The UPWP identifies specific project tasks related to on-going planning processes and ISTEA planning requirements. Each task description includes identification of funding sources and participating and managing agencies responsible for the task. On-going planning efforts which address ISTEA and CAAA requirements are provided for in separate tasks which include the following: Long Range Plan Update, UPWP Development, TIP Development, Regional Council Transportation Planning Support, MPO Board and Municipal Participation, Technical Committees Support, Transportation and Land Use Coordination, Freight Movement Study for Dade County, Comprehensive Bicycle and Pedestrian Planning Programs, Citizen and Private Sector Involvement and Community Awareness, Development of Dade County Congestion Management System, and Air Quality Conformity Determination Assessment.”

d. FHWA and FTA Administrators' Focal Points: ISTEA Fifteen Factors

“ISTEA requires that the fifteen planning factors be explicitly considered and reflected in the products of the planning process. The Metro-Dade MPO submitted an interim update of the 2015 LRTP on December 18, 1994, for review and approval by federal agencies. The submittal included a self-assessment of whether or not the MPO's major planning documents adequately considered the ISTEA fifteen factors. The update suggested that the MPO is specifically addressing the fifteen factors in its UPWP, LRTP, and TIP as well as considering them in the development of the Dade County Mobility Management Plan (DCMMP) discussed earlier.

“In many instances, the Metro-Dade planning process appears to have integrated elements of the fifteen factors such as land use coordination, system maintenance, environmental impacts and congestion mitigation before ISTEA specifically required their consideration. However, from a

review of planning documents and discussions with MPO staff during the site visit, the MPO's approach to some of the fifteen factors appears to be more in the manner of an 'after-the-fact' checklist to ensure compliance with planning regulations rather than an integrated part of their planning process. MPO staff members suggested that they are transitioning from implicit to more explicit consideration of the fifteen factors in their updated planning documents.

"As discussed earlier, in March 1994 the MPO Governing Board adopted revised objectives for the LRTP 2015 update, which explicitly reflect the fifteen factors. MPO staff cited these new objectives and the concurrent development of new project prioritization criteria based on those objectives as an indication of progress towards integrating the fifteen factors into the planning process. The new project selection criteria under development were not available for review at the time of this EPR and, as cited earlier, it is unclear how the criteria are being developed and at what point in the project development and selection process they will be applied.

"In certain areas, such as land use coordination and the promotion of greater transit usage, policies have been and are being put in place which reflect the fifteen factors. Consideration of the impact of transportation planning on land use is highlighted in a number of ways. The County requires that projects contained in the LRTP and TIP be included in the County's Comprehensive Development Master Plan (CDMP) and be consistent with level-of-service standards specified in the CDMP. The CDMP is a requirement of the State of Florida under its land use legislation referred to as the concurrency requirements. Exclusion of a project or facility from the CDMP could prevent Dade County's participation in the project even if it is included in the LRTP.

"Dade County also recently received approval to have the urban infill area (east of SW/NW 77 Avenue) designated as a Transportation Concurrency Exception Area from the State's concurrency requirements. The process of developing the application required state, county, local jurisdictions and transportation agencies to examine the link between further development and its impact on the transportation infrastructure. The application for exception acknowledges that roadways within the urban infill area are already at capacity, and therefore further development could have an effect on both transit ridership and congestion. While the ultimate impact of approval of the application on the transportation system and transit ridership is not clear, the application process in itself represents an effort on the part of local agencies to incorporate and use impacts in their transportation planning decisions.

“In terms of encouraging transit ridership, FDOT officials point to their agency's enactment of the Intrastate Highway System Policies and Priorities legislation, which is a policy limiting the number of general use lanes on Florida's highway system to six lanes. The LOS standards contained in the CDMF also reflect the incorporation of a transit element whereby LOS standards are allowed to exceed capacity where transit is available. Local parking policies and their impact on transportation mode choice on a countywide basis is also the subject of a current parking study being undertaken by the MPO. Staff expressed frustration at their lack of ability to limit the size and availability of parking places, which is often dictated by local jurisdictional land use policies. These local policies often include the establishment of parking space "floors" (minimum space allowances) instead of "ceilings" (maximum space allowances) which might encourage less parking availability and greater transit use. However, in order to fund development, local financial institutions often require these "floors" to ensure plentiful parking.

“Finally, freight considerations are also beginning to be more fully integrated into the planning process. In addition to providing input to FDOT's East-West and MIC study, the MPO is also currently undertaking a comprehensive freight movement study for Dade County. The study will include local transportation agencies, the MPO, and local trucking and freight representatives with the goal of developing a freight movement plan and a freight component to the local transportation modeling efforts.

Observations and Recommendations

- “1. General: The MPO's comprehensive consideration of the ISTEAFifteen Factors in the planning process would strengthen the planning process and the LRTP.
- “2. Land Use: Formal linkages between land use and transportation planning, encouraged by ISTEAF, are difficult to accomplish in most areas. Coordination and consistency between the County's CDMF and products of the MPO planning process and FDOT's restriction on expansion of highway capacity provide a strong foundation for working toward this challenging but vital linkage. Furthermore, the County's application to be designated an exception area to the State's concurrency requirements represents a clear recognition of the link between development, the transportation system, and local land use patterns.
- “3. Land Use/Transit Use: Addressing the impacts of local land use, parking availability, and pricing policies on mode choice and, in particular, on transit ridership would greatly assist the planning

process. The MPO could explore possibilities for revising local land use plans and the CDMP to establish parking place 'maximum' rather than 'minimum' limits in the development process, particularly in areas well served by transit. Other incentives to shift mode choice could also be incorporated in the MPO's project identification criteria and processes."

e. Travel Demand Forecasting

"The Dade County Planning Department functions as the official comprehensive planning agency in performing MPO-related technical planning activities including responsibility for collection, development, and evaluation of land use and socio-economic data and forecasts for use in the travel demand models. As part of the LRTP 2015 update process, the Metro-Dade MPO travel demand model was recently updated with 1993 travel survey data and the 1990 Census information. However, prior to this update, the 1986 base year transportation network for the Dade County urbanized area, projected from 1980 Census data, was the latest validated network. According to Planning Department staff, the delay in updating model inputs was due, in part, to the impact of Hurricane Andrew on the staff of the department."

9. New Orleans FTA/FHWA Enhanced Planning Review
(Lyons, 1996c)

a. Development of the Unified Work Program

"The Unified Work Program (UWP) for fiscal year 1996 includes all federally funded transportation studies for the New Orleans metropolitan area, but not planning efforts funded through other sources. Tables in the UWP identify RPC, LDOTD, and 'RPC Contractual' as recipients of federal funding. There also are several transit studies for which RTA or Jefferson JPTA are identified as carryover fund grantees. Compared to previous years, the UWP for 1996 reflects a more comprehensive approach to improving local traffic conditions, emphasizing the identification of congested conditions and the development of traffic management strategies. The document includes a number of specific tasks that explicitly address many of the ISTEA 15 factors, as follows:

- Land Use/Development Consistency, which will provide an assessment of the mutual effects of decisions concerning land use and transportation, as well as maintenance of a land use geographic information system;"

b. FHWA and FTA Administrators' Focal Points: ISTEA Fifteen

Factors

“Both the Transportation Plan and the UWP cite the 15 factors as a framework for the planning process and provide evidence of substantive efforts to address the fifteen factors, as follows:

- Impacts of Transportation on Land Use: RPC is developing technical tools, including a regional geocadastre system, for the purpose of facilitating the analysis of transportation and land use linkages.”

c. Meetings with Local Elected Officials: Transportation Policy Committee and TAC

- “A major issue concerning freight in New Orleans is truck movement through residential neighborhoods, because residential and industrial land uses are located in close proximity to one another. The transportation of hazardous materials represents a particular problem in this respect. The need for improvements to existing bridges also is critical. Grade crossing problems represent another significant concern.”

10. Northern New Jersey FTA/FHWA Enhanced Planning Review
(Lyons, 1996f)

a. The Northern New Jersey Metropolitan Area: Projections and Forecasts

“From 1970 to 1990, the number of the region's jobs that were located in urbanized Essex and Hudson counties declined from one-third to one-fifth. Simultaneously, the less densely populated Bergen, Middlesex, Monmouth, and Morris counties captured more than 70% of the new jobs created since 1970. The building of housing complexes and office parks in once isolated suburban locations has resulted in suburban land use patterns oriented exclusively to travel by auto. The low density patterns work contrary to cost-effective transit services. Since 1940, the percentage of the region's residents living at densities that make high-frequency bus service feasible has declined from nearly 50% to barely 20% today. Auto registration has tripled over the last 40 years, adding two million more cars to the region.”

b. Development of the Regional Transportation Plan

“The Regional Transportation Plan (RTP) for Northern New Jersey,

adopted on August 14, 1995, represents the first post-ISTEA plan update. ISTEA's impact on the development of the RTP update is reflected in a movement in the RTP's focus from project implementation to a system-wide mobility, corridor problem-solving approach. The RTP identifies nine issues and challenges that must be addressed in the transportation planning process:

- Infrastructure Repair, Replacement & Maintenance
- Limitations of the Commuter Rail Network
- Transportation Availability
- Preservation of Rights-of-Way for Future Transportation
- Road Congestion
- Suburban Mobility
- Safety and Security
- Travel Alternatives
- Freight System

“In response to these issues, the NJTPA established goals and objectives in the RTP which will be used to evaluate and rank proposed transportation projects and to guide long-range planning. The goals and objectives were developed based on both discussions by NJTPA Board Members and input received from diverse transportation ‘stakeholders’ during public meetings held to discuss the RTP. The goals and objectives are as follows:

“1. Protect and Improve the Quality of Natural Ecosystems and the Human Environment

1A: Make transportation decisions that are compatible with protection of our key regional ecosystems.

1B: Provide attractive alternatives to single-occupant driving.

1C: Aggressively pursue advances in technology that can create more reliable, efficient, and less environmentally damaging transportation systems.

“2. Provide affordable, accessible and dynamic transportation systems responsive to current and future customers

2A: Fix the highway network to relieve serious localized congestion and safety problems.

2B: Expand the transit system to provide fuller coverage of the region.

2C: Provide transportation mobility to citizens of the region

necessary to carry out essential daily activities.

2D: Strive to find and implement solutions to mobility problems that are appropriate to local conditions and needs.

2E: Provide opportunities for input and involvement by individuals, businesses and interest groups in planning processes to help guide investment decisions.

“3. Retain and increase economic activity and competitiveness

3A: Build a sustainable economic future where people, goods and information move freely in the landscape but not such that the valued features of our urban, suburban and rural landscapes are sacrificed in the process.

3B: Reduce the cost of doing business in the region by providing for efficient movement of goods, people and information.

“4. Enhance system coordination, efficiency, and intermodal connectivity

4A: Strive to create a fully intermodal transportation system, looking for both present and a wide range of future opportunities.

4B: Develop the knowledge and planning capacity needed to make the difficult mobility choices ahead.

“5. Maintain a safe and reliable transportation system in a state of good repair

5A: Maintain, repair and replace most of the existing transportation system.

5B: While attending to backlogged repair and maintenance needs, also undertake transportation investments that best advance and sustain future economic viability and performance.

“6. Support the coordination of land use with transportation systems

6A: Promote community design that can reduce transportation requirements while still meeting the needs of our citizens for mobility to their daily activities.

6B: Consider land development outcomes and possibilities in transportation decisions.

“The RTP presents background and demographic information to assess the current and future demands on the transportation network and the ability of the network to meet those demands. This includes an analysis of trends in population growth and density, household demographics, automobile ownership, employment, office space, retailing, goods movement, and journey-to-work characteristics. The impact of national and state priorities and legislation on the NJTPA's transportation planning and investments is also presented in summary.”

c. FHWA and FTA Administrators' Focal Points: ISTEA Fifteen Factors

“Many elements of the ISTEA fifteen planning factors are incorporated into various state legislative bills which guide planning at the state, regional, MPO and local level. The State Development and Redevelopment Plan (SDRP), adopted in June of 1992, contains a set of interrelated goals which include:

- Revitalization of the State's urban centers and areas.
- Protection of the environment.
- Conservation of the State's natural resources.
- Promotion of beneficial economic growth, development, and renewal.
- Providing for adequate public services at a reasonable cost.
- Preservation and enhancement of historic, cultural, open space, and recreational lands and structures.
- Ensuring sound and integrated planning statewide.

“The SDRP is intended to be a guide for municipal and county master planning, state agency planning, and infrastructure investment at all levels. Under the SDRP, the State is divided into five planning areas characterized by varying levels of population and employment and reflecting different mixes of buildings, natural features, and the infrastructure influencing both. The SDRP is also intended to guide future development growth into more compact forms of development, known as centers. According to the SDRP, the objectives for transportation infrastructure are to encourage types of development ‘that will financially support a balance among modes of transportation necessary to minimize

air quality deterioration, minimize increases in highway travel demand, and still provide safe access to trip destination.’ To that end, the SDRP sets forth twenty policies for transportation planning and investments which reflect the ISTEA fifteen planning factors.

“A number of other local pieces of legislation tie development and land use to transportation planning. The Municipal Land Use Law, the Transportation Development District Act, and the State Highway Access Management Code seek to address traffic impacts that result from new development. These laws require a combination of off-site improvements, user fees, and restricted access to state roadways to control the impact of development on the transportation network.”

11. Philadelphia FTA/FHWA Enhanced Planning Review (Lyons, 1996g)

a. Organization and Management of the Planning Process

“Representatives of DVRPC's Board stated that the committee structure provides an effective forum for the Board members to communicate regularly and to address transportation policies and projects on a regional level. The Board of Commissioners of DVRPC is supported by the following principal committees:

- Regional Transportation Committee (RTC), which advises the Board on transportation planning issues;
- Regional Air Quality Committee (RAQC), which provides a forum for addressing air quality and related transportation issues; and
- Regional Citizens' Committee (RCC), which provides an opportunity for citizens to address transportation issues.

“To better respond to ISTEA concerns, additional committees and task forces have been added in the last few years to address bicycle mobility and goods movement and to improve integration of local land use planning.

“Although major transportation providers and organizations are represented on the Board, some Board members stated that their jurisdiction or organization could be better represented. Philadelphia, which contains 30 percent of the population of the region, has only one vote. Also, SEPTA, which serves Philadelphia and its Pennsylvania suburbs and is the region's largest transit operator, has sought voting status. Since the MPO's inception, no changes in membership have been

made to its Board. According to DVRPC's Executive Director, altering the Board's membership would be a complicated and difficult process and would undermine the delicate balance that has been achieved. Any changes would require revising the enabling legislation passed by Pennsylvania and New Jersey.

“Another representation issue involves the 352 local townships and boroughs located in Pennsylvania and New Jersey. They are called Minor Civil Divisions (MCDs) in Pennsylvania and municipalities in New Jersey. They do not have direct membership in the MPO; instead, they are represented in the regional planning process by their respective counties. From an organizational standpoint, since the number of MCDs in the region are numerous, this appears to be a logical and efficient structure. However, for the planning process to work effectively, particularly at the regional level, each of the counties must maintain very good lines of communication with these communities and coordinate their county-wide plans with the local land use, land development, and transportation planning activities. No policies or guidelines exist to ensure that this occurs on a consistent and regular basis.

“During the planning review, representatives of the Board of Commissioners and the MPO's staff stated that local jurisdictions are frequently the source of many of the projects that eventually reach the MPO through the TIP development process. Representatives from Pennsylvania and New Jersey stressed that local jurisdictions are identifying needs, conceptualizing projects, and conducting land use planning independent of the regional planning process. Board members further indicated that, while they represent their local jurisdictions and transportation organizations, the planning requirements in ISTEA impel them to plan in the context of a regional view more than in the past.

“The DVRPC's Executive Director identified developing stronger transportation and land use links as a major issue facing the region, particularly in Pennsylvania, where each town is granted land use controls through state legislation. At the same time, he stated that the possibility of developing these links would be very difficult, given that a large number of jurisdictions have these controls and state legislation would have to be changed. Even in this environment, the MPO's staff is currently considering ways to more regularly involve local jurisdictions and educate them in the regional planning process. The MPO's adopted centers and corridors approach (which was developed in conjunction with the MPO's long-range transportation planning process) is intended to introduce regional land use considerations into local decision making. Some of the region's local jurisdictions have formed transportation management associations in an effort to secure representation at the MPO level. To

date, there are four associations on the Pennsylvania side and three on the New Jersey side of the MPO region.

“The MPO maintains institutional relationships with state transportation and air quality organizations and with transportation providers. Formal written agreements defining organizational responsibilities for air quality planning and for TIP development are in the process of being completed.

Observations and Recommendations

- “1. Inclusion of Relevant and Concerned Groups: The Board of Commissioners includes non-voting members, such as the transit operators and the Chair of the MPO's citizens committee.
- “2. New Committees: The MPO has created new committees and task forces in response to the ISTEA requirements that address issues such as the importance of goods movement and the link between transportation and land use.
- “3. Serving the Needs of Its Membership: The MPO's staff serves regional planning needs by providing technical and policy-making assistance to each of its members. This is particularly complex at times because Pennsylvania and New Jersey often have different methods and approaches for similar tasks.

- “4. Representation of Local Jurisdictions: The MCDs on the Pennsylvania side of the metropolitan area, which are towns within the counties, do not have direct representation in the regional planning process. During the review, members of the federal team suggested that the Board could consider creating a task force as a mechanism to amplify their current efforts to incorporate the MCDs more directly into the regional planning process.
- “5. Formal Agreements: The planning process does not have formal written agreements in place defining the roles and responsibilities between the MPO, the states, and transit operators.”

b. Development of the Regional Transportation Plan

“The Year 2015 Transportation Plan, completed in September of 1993, is the current plan and the first long-range plan prepared since passage of ISTEA and the CAAA. A new long-range plan for the year 2020, scheduled for completion in the spring of 1995, has since been adopted. A key element in the 2020 Plan is the integration of land use with transportation. The 2020 Plan is part of a more comprehensive effort, known as DIRECTION 2020, which is the MPO's first effort at integrating all modes into the regional planning process. It includes bicycle and pedestrian mobility elements, urban goods movement, and airports. For DIRECTION 2020, DVRPC staff prepared more than thirty reports which provide a foundation for policy-making and public participation. Many of the reports define regional transportation goals, objectives, policies, and action steps. Of the DIRECTION 2020 reports, four make up the 2020 Plan: 1) a policy agenda; 2) a summary document of the physical infrastructure; 3) a summary of people and goods movement; and 4) a technical report of forty-four identified centers and corridors. Only two of the reports--the policy agenda and the one documenting the corridor and center alternatives--were complete at the time of the review.

“In preparing the centers and corridors document, the MPO developed two scenarios. The first projected current growth trends with the majority of the new development in the region occurring in the suburban fringes. The MPO has embraced the second scenario in which physical growth is constrained and cluster development occurs along forty-four corridors in proximity to existing highway and transit lines.

“The MPO Board and staff have concluded that implementing the constrained physical growth scenario would enable the region to meet ISTEA and CAAA requirements of managing VMT growth and improving air quality; however, the scenario assumes implementation and adherence to the recommendations at the MCD level. Currently, legal

means to strengthen region wide planning, specifically the coordination of land use controls, do not exist. Therefore, without changing local land use controls, the unconstrained growth scenario may have a greater chance of occurring given historical trends.

“Although the constrained scenario establishes a vision for the region to embrace, it remains somewhat general at this point. That is, the planning approach does not consider alternatives that identify the design concept and scope of projects that need to be undertaken in each of the corridors to meet anticipated travel demand needs, along with anticipated levels of funding. The MPO intends that the major investment study (MIS) process and corridor level planning activities will further define plan features and be reflected in triennial updates of the plan.

“The lack of project specificity raises a number of issues. First, determining whether or not the long-range planning effort is financially constrained is difficult. Secondly, the MPO does not appear to have a road map for addressing and resolving many of the major transportation issues that it has identified as important or urgent, such as an aging, decaying infrastructure, increased travel and congestion in the suburbs, and center city revitalization. Finally, the air quality conformity analysis can only provide the region with an incomplete ‘picture’ of the emission impacts that would result from different transportation decisions.

“Although the region's transit systems are significant in terms of their coverage and patronage, the plan does not present a regional transit strategy with complete integration into the multimodal planning process. In many respects, the MPO's regional concept for land use and transportation development (as defined by the constrained physical growth scenario) provides a broad base for taking this next step and developing an intermodal plan. Similarly, a study, which was commissioned by SEPTA's Board several years ago and has emerged as the authority's long-range plan, provides another jumping-off place for developing an integrated, intermodal regional plan. The document was a significant resource to the MPO project teams during the preparation of the centers and corridors report. Its recommendations were embraced to varying degrees throughout the Pennsylvania portion of the region.

“During the planning review, the transit operators indicated that they plan independently, and no direct links existed between their long-range planning activities and the MPO's efforts. Further refinement of a transit vision will require closer coordination among the different organizations within the regional planning process.”

c. Development of the Transportation Improvement Program

“Discussions during the planning review indicated that short-term programming, that is, the preparation of the TIP, is the main focus of the metropolitan transportation planning process. The MPO has adopted procedures for identifying and prioritizing all project submissions for the TIP. It is through this process that local jurisdictions and transportation providers decide which projects to fund. With the assistance of MPO staff, the counties and the region's transportation operators score their individual project's ability to meet the following regional goals:

- Preserve and Modernize Key Elements of the Existing System.
- Improve Safety and Security.
- Mitigate Congestion.
- Protect and Improve the Environment.
- Support Economic Activity.
- Improve Mobility of People and Goods.
- Support Land Use Plans and Goals.

“According to members of the MPO's Board, the requirements for financial constraint and procedures for prioritizing projects have caused member governments, such as Camden and Philadelphia, and other organizations, such as SEPTA, to participate in the TIP development process to a greater degree than ever before. Without a high level of participation, member governments were concerned that their projects would not be advanced, and that their jurisdictions or agencies would not receive their fair share of federal dollars.

“Just as they are not directly represented at the MPO level, local jurisdictions are not directly involved in the identification or advancement of projects that would be considered for inclusion in the TIP. According to the documents provided, municipal planners and engineers generate project lists that are reviewed at the county level; however, the region has no policies to ensure the participation of the jurisdictions with their respective counties is consistent and cooperative. Although there are procedures for the county's involvement in the regional planning process, no formal roles exist for local jurisdictions at the MPO level.”

d. FHWA and FTA Administrators' Focal Points: Financial Planning and Financial Constraint

“The preparation of a financially constrained plan requires moving beyond the time frame of the TIP and identifying improvements that are consistent with the long-range vision. However, the design concept and scope for improvements to be built with the uncommitted \$13.4 billion have not yet been determined. Until these difficult tasks are completed through the regional planning process, the steps that the region must take to meet its accepted vision for transportation and land use development will not be clear.”

e. FHWA and FTA Administrators' Focal Points: ISTEA Fifteen Factors

“Many of the fifteen factors have been implicitly understood and have been incorporated into the region's planning and decision-making activities even before ISTEA. Since the passage of ISTEA, the MPO has initiated efforts to directly address some of the factors. This is evident in the goals that have been adopted to guide the development of the transportation plan, the TIP project prioritization criteria, and the planning projects that have been included in the UPWP. The MPO has also initiated additional programs and created new committees that support the implementation of several of the fifteen factors, some of which are discussed below.”

(1) Initiation of Bicycle Planning

“Within the region, bicycling and walking to work are difficult due to the age and design of the region's existing infrastructure and the density of population along many of its older corridors. The region currently has 1900 miles of bikeways; however, they are recreational in nature (i.e., not suited for work or shopping type trips) and are located mostly in state and local parks. Regional planners estimate the bicycle mode share for commuting to work to be about 1 percent.

“DVRPC also established a bicycle/pedestrian steering committee to serve the communities on the Pennsylvania side of the bi-state region. Its members — which currently include DVRPC staff, the Pennsylvania counties, bicycle advocates, the general public, environmental groups, and PennDOT — meet every three months. The committee began by collecting information on frequency, trip purpose, trip distances, and attitudes toward bicycling. The information was then used to identify regional bicycling issues.

“The committee is currently working to develop a concept for a regional bicycle network on the Pennsylvania side. It has decided that the network should be designed to interconnect with existing transportation facilities,

provide connectivity between jurisdictions, and facilitate long distance and commuting type trips. The committee is proceeding to rank travel routes identified by planners from each of the counties. They have concluded that their highest priority should be paths located along state, county, or local roads. TIP projects are also being reviewed by the committee to ensure that the proposed paths are rational from a network perspective and compatible with other programmed projects. In recent months, the MPO's staff has begun working with a consultant, under contract to the State of New Jersey, who has been hired to develop a statewide bicycle plan.

"The MPO believes that pedestrian planning is more appropriately addressed in detail at the local level and is currently doing so in local Greenway plans, the 'Reinvesting in Cities' plan, and other local center and corridor plans."

(2) Integration of Land Use and Transportation

"The MPO's staff identified the integration of land use and transportation planning as a major issue facing the region. The possibility of achieving cohesive land use planning as a means to encourage more efficient transportation activity will be particularly difficult to achieve in Pennsylvania since the Commonwealth of Pennsylvania delegates land use authority to MCDs through Home Rule. Even so, the MPO has recently established a policy committee to address the issue and explore means for achieving greater regional land use coordination. In addition, the MPO has written a policy report on land use and transportation. This report recommends specific policies to address the links between land use and transportation, coupled with suggested actions for each policy. The MPO stated that it has distributed all significant draft 2020 reports and a survey mailer on key issues and priorities for the region to each of the 352 municipalities."

(3) Observations and Recommendations

- "3. Land Use: The MPO and the states recognize the importance of the relationship between land use and transportation planning and the limitations that Home Rule imposes on the effectiveness of regional planning. The MPO has created a role for itself within this constrained environment as an educator and advocate for better communication and cohesion among the jurisdictions.
- "4. Pedestrian Plan: No strategies have been identified for inventorying or developing a pedestrian pathway system linking, for example, transportation centers and nodes.

f. Integration of Strategic Transportation Planning

- “1. Suburban versus Downtown Focus: At the same time that SEPTA recognizes the need to move forward with new services to meet suburban demands, it also faces the capital expense burdens presented by a deteriorating infrastructure located primarily in the urban core. Due to the high cost of rehabilitating its infrastructure and its lack of a dedicated local funding source, SEPTA could have limited financial resources over the short and long term to commit to suburban solutions.
- “2. Integration of Transit Planning: The MPO's regional concept for land use and transportation development that it prepared for the 2020 Plan could provide a common base for the planning that is being conducted by each of the transit providers and could further integrate the transit providers into the long-range planning process. Also, as the region begins to undertake major investment studies, the federal team fully expects that the collaborative process that is in place and that includes all modal actors, will continue.”

g. Travel Demand Forecasting

“The MPO is encouraged to continue developing its GIS-T capability so that it can better gauge the impact of land use and transportation changes. This capability could be particularly useful when developing MIS or providing local support to counties and townships.”

h. Conclusion

“As reflected in the observations throughout this report, the federal team identified several areas where the MPO and the participating agencies in the local transportation planning process appear to have successfully implemented comprehensive and coordinated planning practices. In particular, these include the following areas:

- Commitment to making travel demand modeling enhancements.
- Consideration of the link between transportation and land use planning.
- Technical assistance provided to Pennsylvania and New Jersey member jurisdictions, and when requested, to local jurisdictions.

“Conversely, the federal team identified specific areas of activity where continued progress should improve the transportation planning process in

the Philadelphia metropolitan area. These include the following areas:

- Better integration of transit plans into the intermodal transportation plan for the region.
- Further development of a more specific long-range plan, with the identification of investments (or placeholders), particularly for improving conformity and financial analyses.
- Refinement of the financial component of the 2020 Plan, assuming it is comparable to what was completed for the 2015 Plan.
- Development of scenarios and a long-range vision for the 2020 Plan.
- Further progress in the development of the Congestion Management System.
- Development of a pedestrian plan.
- Adoption of agreements as required under the Planning Regulations.
- Fostering a better understanding of the regional transportation planning process by Minor Civil Divisions (MCDs) and the relation of their land use decisions to transportation needs.”

12. Salt Lake City FTA/FHWA Enhanced Planning Review (Lyons, 1996b)

a. Local Conditions: Projections and Forecasts

“Land use planning in the Wasatch Front region is the responsibility of local municipalities. WFRC develops region wide land use forecasts by compiling local master plans. Master plans prepared by local governments show that most developable land is planned for low density residential use in both Salt Lake and Ogden. Some high density residential and commercial development is planned for Salt Lake City, Ogden City, and the I-15 and US 89 corridors. Additional commercial development also is anticipated throughout the metropolitan area to serve dispersed residential growth. Most of the expected increase in population is expected in suburban areas, with residential development in the Salt Lake Area forming an expanding semi-circle around the central city. Industrial land uses will continue to be concentrated along I-15.”

b. Development of the Transportation Plan

“WFRC’s technical staff prepares separate Transportation Plans for Salt Lake and Ogden, because of the different character of transportation conditions in each of these areas.

“The Plans follow the same format and share much common text, discussing goals and objectives, characteristics of the areas, projected long-range needs, management systems, finances, program recommendations, and plan evaluations. The four goals and supporting objectives identified in the Plans, which are common to both, were developed by WFRC in 1972-73, and have not been revised under ISTEA. The four goals are to provide:

- An efficient, safe, and economical transportation. Supporting objectives include minimizing congestion, travel time, accidents, and capital costs.
- A transportation system with minimal adverse impact on environmental, sociological, and aesthetic values. Objectives include minimizing pollution, energy consumption, community disruptions, and property dislocations.
- A balanced, coordinated transportation system (auto, air, transit). The objectives relate to multimodalism and providing an equitable distribution of transportation services.
- A transportation system to complement desired community development patterns. Objectives include providing consistency with land use plans and accessibility to community services.”

c. FHWA and FTA Administrators' Focal Points: Public Involvement

“Participation in Specific Studies - The MPO has found that one of the most effective ways of interacting with the public is to include private citizens on teams preparing land use master plans, EISs, or other special projects. Representatives from the WFRC also are available to meet with civic and interest groups upon request.”

d. FHWA and FTA Administrators' Focal Points: ISTEA Fifteen Factors

“Consistency with Land Use Plans: The Transportation Plans acknowledge that additional work is needed. Comprehensive planning and zoning are almost exclusively the responsibility of local governments. Nearly every jurisdiction has a master plan, but there is little formal

coordination among these communities. WFRM has compiled local master plans and combined them into a single, composite map. The local plans also have been examined in terms of their consistency with regional demographic and transportation plans. WFRM perceives a growing public interest in improving coordination among local master plans and assessing the transportation impacts of rapid growth. WFRM has not analyzed alternative land use scenarios as part of its planning process. WFRM has been exploring computer satellite imagery processing techniques as a substitute for conventional sources of land use inventory data, which are inadequate for regional transportation planning.

Observations and Recommendations

- “1. Integration of Factors: The current versions of the Transportation Plans consider the fifteen factors primarily in the context of an after the fact evaluation. In the time period following the development of the Transportation Plans, however, the factors do appear to have influenced the planning process, as reflected in efforts to improve the evaluation of social, environmental, and economic impacts; provide for corridor preservation; address goods movement issues; and improve long-range transit planning.
- “2. Goods Movement: A more aggressive approach to freight planning may be required if contacts with industry groups do not yield useful information on goods movement needs and issues. A broader perspective would address systemwide intermodal connections and land use compatibility issues.
- “3. Land Use: WFRM staff does a good job at reconciling local land use plans through its production of a regional land use map, and should try to obtain policy board endorsement of its land use projections. WFRM also could develop and analyze alternative transportation/land use scenarios, which could be presented in the Transportation Plan. The MPO has demonstrated strong initiative in using computer satellite imagery.”

e. Meetings with Representatives of the General Public and Local Elected Officials

(1) General Public

“The EPR site visit included a meeting of the federal team with representatives of the general public, who were invited by WFRM. WFRM had sent a notice concerning the meeting to individuals on its public review list for the TIP, which includes thirteen names. Four people

Land Use Planning ■

attended the meeting, one of whom was not on the mailing list. Those in attendance were activists, three of whom were affiliated with environmental or community groups, and one who had a long history of involvement in the local transportation planning process. Their comments are summarized below.

- Land use information provided by the local governments to WFRC is weak. Federal funding for the collection of inventory data was discontinued in the 1980s, and as a result, the land use information generated by local governments has an inadequate basis in field surveillance.
- Public attitudes toward growth management and land use planning are becoming more positive. Six thousand new members from the Salt Lake area joined the Sierra Club last summer. The press also has shown increased interest in planning issues.
- There has been little opportunity for environmental or community groups to become involved in the planning process. It is only recently that local environmental groups have organized around transportation issues. Citizens care about the issues but do not know how to participate in the planning process. The general public also has no knowledge of ISTEA.
- Better information and training are needed if the general public is to participate successfully in the planning process. Suggested ideas for educating citizens include the use of electronic bulletin boards and sponsorship or co-sponsorship of conferences and open houses. ISTEA workshops also would be helpful.
- The education and involvement of grassroots organizations is critical, because the tenure of public officeholders is brief.

(2) Local Elected Officials

- The mayors noted that there is intense interest in transportation issues among people who live and work in the region. One mayor said that the issues raised most frequently by his constituents concern transportation. The mayors support an increased emphasis on the linkages between land use and transportation as part of the planning process.”

f. Conclusion

“Potential areas of improvement include increasing the emphasis on multimodalism, which extends to bicycle and pedestrian planning,

developing and integrating transit improvements in the Transportation Plan beyond short-term improvements, and integrating transportation planning within a broader vision encompassing land use, environmental, and social goals. There is evidence of increasing public interest in metropolitan area planning issues, which warrants development of a more proactive approach to public involvement.”

13. San Francisco Bay Area FTA/FHWA Enhanced Planning Review (Lyons, 1996j)

a. The San Francisco Bay Metropolitan Area: Projections and Forecasts

“Decentralized development is expected to continue. Current local land use policies show that 52% of the total acreage available for future development is located in the North Bay counties (Marin, Napa, Solano, and Sonoma). Much of the remaining land available for development is in the eastern portions of Alameda and Contra Costa counties. These are, geographically, the ‘fringe areas’ of the region.”

b. Organization and Management of the Planning Process: Institutional Relationships

“MTC, ABAG, and Caltrans have a Memorandum of Understanding (MOU) through which they agree to share land use and transportation forecasts. For example, ABAG supplies MTC with land use projections for use in forecasting travel demand in the Regional Transportation Plan (RTP) and, in turn, MTC provides transportation forecasts to ABAG for use in their next cycle of land use projections. The current MOU was last amended in 1986 and is in the process of being updated.

“ABAGs demographic and land use projections are used for travel forecasts by local planning organizations, MTC, and Caltrans. Coordination of regional data has become especially important with the establishment of County Congestion Management Agencies (CMAs), which also must perform travel forecasts.

“CMAs came into existence as a result of state legislation and voters approval of Prop 111 in 1990. The CMAs take the responsibility of preparing and implementing county level transportation plans, called Congestion Management Plans (CMPs). State law requires that the county plans serve as the basis for the RTP, in addition to which the MPO must address regional issues not addressed by the CMPs. State law requires the CMPs to establish levels of service standards for roadways, set transit service standards, develop trip-reduction and travel demand

management programs, perform land use impact analyses, formulate capital improvement programs, and monitor conformity to the county CMP.”

c. Development of the Regional Transportation Plan

“Development of the 1994 RTP began with identification by MTC staff of three alternative policy options for the Draft Capital Investment Plan. These options were:

- Option 1a: A planning effort based on addressing prior commitments and local plans.
- Option 1b: A planning effort based on system maintenance and operations management.
- Option 1c: A planning effort based on coordinating transportation and land use.

“After much public scrutiny of these options and meetings with staff and local officials, a consensus emerged that these three strategies were complementary and that all were necessary in some degree. The strategic direction reflected in the 1994 RTP combines elements of each of these options.”

d. FHWA and FTA Administrators' Focal Points: Major Investment Studies

“A potential sponsor of a major transportation investment may initiate the MIS process by calling a meeting with, at a minimum, representatives of MTC, affected operators, Caltrans District 4, FHWA, FTA, and the CMAs for all affected counties. If the need for an MIS is confirmed, additional parties including resource agencies, environmental agencies, and affected jurisdictions must also be involved to determine roles and responsibilities, the scope of the MIS, how the public will be involved, data requirements, and evaluation measures. ABAGs regional land use projections must be used as a starting point for land use analysis, but the parties above may decide to explore changes in local land use policies.”

e. Travel Demand Forecasting

“MTC is one of a number of organizations that collects transportation, economic, and land use data and does forecasting and modeling in the region. ABAG collects regional economic and land use data and produces employment, population, land use, and other forecasts. Caltrans collects transportation data through its Highway Performance Monitoring System (HPMS). Coordinating these different forecasting and modeling processes, particularly reaching agreement on assumptions and using data from other sources to validate model results, is a challenge in the region. For example, ABAG forecasts for a twenty-year period relative to the most recent decennial census. This period does not always conform to the period covered in the RTP. ABAG does provide longer range forecasts when requested to do so by MTC. The MTC does not use the HPMS data, which has led to discrepancies between HPMS and the MTC model results.”

f. Conclusion

“Conversely, the federal team identified specific areas that could be addressed to improve the transportation planning process in the San Francisco Bay Area. These include:

- Strengthening integration of transportation and land use modeling and planning.

14. Seattle-Tacoma-Everett FTA/FHWA Enhanced Planning Review (Lyons, 1996d)

a. Organization and Management of the Planning Process

“PSRC was created in 1991, replacing the Puget Sound Council of Governments (PSCOG), the former MPO for the Central Puget Sound Region. In the face of disputes with local jurisdictions and waning support from its membership, the PSCOG was replaced by PSRC, which was created through State enabling legislation. Compared with its predecessor agency, PSRC has a more clearly defined and narrowly focused mandate, which is limited to planning functions related to regional transportation and growth management.

“The State of Washington's Growth Management Act (GMA), adopted in 1990 and amended in 1991 and 1994, establishes a framework for the integration of transportation and land use planning in which regional transportation agencies play a prominent role. In accordance with the GMA framework, PSRC serves as a forum for collaborative work on the continuing development and implementation of the region's growth and transportation strategy, as set forth in the regional plan, VISION 2020. VISION 2020 articulates a public policy foundation for regional planning that promotes compact patterns of urban growth and the development of a compatible transportation network. Solutions to congestion problems and mobility needs emphasize transit, ridesharing, demand management, and the maintenance of current facilities, rather than continuing expansion of highway capacity for single-occupant vehicles.

“Multi-county policies contained in VISION 2020 build on countywide planning policies and comprehensive plans developed by member governments, and are designed to provide guidance to agencies and local jurisdictions on issues related to the region's economy, transportation, and environment. The approach to planning embodied in the GMA and VISION 2020, and followed by PSRC, reflects the tradition in the state of ‘bottom-up’ decision-making, in which local jurisdictions lead the process, which is coordinated at the regional level in compliance with statewide policies. In seeking to build an inclusive institutional framework for the planning process, PSRC actively pursues partnerships with public agencies and private organizations that have an interest in transportation decision-making.”

b. Development of the Transportation Plan

“The Metropolitan Transportation Plan (MTP) identifies long-range transportation strategies and investments for the Seattle-Tacoma-Everett

metropolitan area, developing in greater detail the policies set forth in VISION 2020, the region's long-range growth management, economic, and transportation strategy. This MTP is the first transportation plan for the region developed to meet ISTEA requirements.

“VISION 2020 was adopted in 1990, preceding the State of Washington's GMA, and has been updated several times. The 1995 update incorporates the MTP as its transportation component. A guiding principle of VISION 2020 is to support the concentration of growth in urban areas for the purpose of conserving open space and resource lands, including farmlands and forests. This principle is the foundation of the multicounty policies that are required under the GMA, and which form the basis of the MTP.

“The VISION 2020 multicounty transportation policies are presented in the MTP as objectives to be addressed through the planning process. These policies are as follows: Optimize and Manage the Use of Transportation Facilities and Services; Manage Travel Demand Addressing Traffic Congestion and Environmental Objectives; Focus Transportation Investments Supporting Transit and Pedestrian-Oriented Land Use Patterns; and Expand Transportation Capacity Offering Greater Mobility Options through development of multimodal facilities.

Observations and Recommendations

- “1. Evolution of the Planning Process: The planning process for the metropolitan area currently is a work in progress, developing on the unique foundation of the VISION 2020 long-range growth and transportation strategy. The comprehensive approach to land use and transportation planning set forth in VISION 2020 reflects the mandates of the State Environmental Planning Act and Growth Management Act, which together establish a context in which planning addresses both the physical and social consequences of growth.
- “2. Transportation/Land Use Linkages: As the land use planning process is brought to completion, the PSRC will more fully establish the linkage between land use priorities and transportation improvements. The transportation planning process should reflect this linkage in developing regional transportation improvements and establishing investment priorities among projects included on the supplementary list to the MTP.”

c. FHWA and FTA Administrators' Focal Points: Congestion Management System and Other ISTEAs Management Systems

"A work program for the Congestion Management System (CMS) was prepared by PSRC to meet the federal October 1994 deadline in the ISTEAs rule. PSRC was selected by the U.S. Department of Transportation to conduct one of four national case studies examining the integration of Intelligent Transportation Systems (ITS) in the CMS. PSRC's approach emphasizes integration of the CMS in the planning process and analysis of congestion within a multimodal context. The relationship of congestion management to land use planning also will be addressed in compliance with the GMA concurrency requirement mandating that 'land development and the transportation network be mutually compatible.' The CMS will play a key role in the performance monitoring effort planned in conjunction with VISION 2020 and suggested in the GMA."

d. FHWA and FTA Administrators' Focal Points: ISTEAs Fifteen Factors

"PSRC's planning process reflects substantial progress in addressing the fifteen factors. The foundations of this process in VISION 2020, the GMA, and the SEPA provide for the integration of transportation into a broad socioeconomic and environmental context, which is consistent with the objectives of ISTEAs. The MTP is a component of VISION 2020 and is conceived as an integral part of the region's growth management strategy.

"Factors that are particular strengths of the planning process include the following:

- Consistency with and Impact on Land Use Plans: The MTP links regional growth management objectives and policies with transportation programs as required by the state's GMA. PSRC has worked with local governments to develop a review and certification process to ensure conformity of local transportation and land use plans with VISION 2020 and the MTP."

e. Meetings with Local Elected Officials

"The public is lagging in its understanding of the need to shift funds from roadways to alternative modes, and of the interconnection between transportation and land use. The Executive Board needs to strike a balance between reflecting the public will and demonstrating leadership. While PSRC does an excellent job of presenting information to the public

in a form that is understandable, improved public education still is needed. Local officials and the U.S. Department of Transportation also must work to educate recently elected U.S. Representatives about transportation.”

f. Conclusions

“PSRC and its partner agencies have responded to the challenges of ISTEA and state law by establishing a process that integrates transportation within its broader environmental and socioeconomic context. This process, which is still evolving, has resulted in innovative planning approaches, including: creation of a Freight Mobility Round Table; development of plans for a nonmotorized transportation network of bicycle and pedestrian facilities; adoption of an incentive program to encourage the use of alternatives to drive-alone automobile travel; development of active partnerships with community groups and interest groups; and incorporation of land use and environmental considerations as fundamental elements of transportation planning.”

15. Washington, DC Area FTA/FHWA Enhanced Planning Review (Lyons, 1996k)

a. Organization and Management of the Planning Process

“The National Capital Region Transportation Planning Board (TPB) is the Metropolitan Planning Organization (MPO) for the Washington, D.C. metropolitan area. The TPB was created in 1965 by local and state governments in the Washington region to respond to a requirement of the 1962 highway legislation for establishment of official metropolitan planning organizations (MPOs). The TPB became associated with the Metropolitan Washington Council of Governments in 1966, serving as COG's transportation policy committee.

“MPO staffing is provided by the Department of Transportation Planning of the Metropolitan Washington Council of Governments (MWCOG). MWCOG provides a variety of services to member county and local governments in the Washington, D.C. metropolitan area. MPO members include the Washington, D.C., Maryland, and Virginia transportation departments, eighteen cities and counties, representatives from the Washington, D.C. City Council and Maryland and Virginia legislatures, and the Washington Metropolitan Area Transit Authority (WMATA). This is a complex, multistate area, and the structure and activities of the MPO reflect this complexity.

“A General Memorandum of Agreement defines the roles of the various local agencies and state transportation agencies in the planning process.

Land Use Planning ■

Responsibilities for the primary planning and programming activities are described in the Unified Planning Work Program (UPWP), as is the relationship between land use, environmental, and transportation planning for the area. Policy coordination of land use and transportation planning is the responsibility of the MWCOG, through its Metropolitan Development Policy Committee and the TPB. Air quality planning is coordinated through the participation of the TPB Chair and the transportation directors for Washington, D.C., Maryland, and Virginia in the Metropolitan Washington Air Quality Committee (MWAQC). MWAQC is responsible for regional air quality planning, and staffing for its activities are provided by MWCOG's Department of Environmental Planning."

b. FHWA and FTA Administrators' Focal Points: Air Quality and Conformity

"Changes in the inputs for the conformity analysis can occur due to decisions by project sponsors, proposed major changes in land use, or actions of the state legislatures. For example, a decision to site a major facility, which will attract high-volumes of traffic, in a part of the region where the transportation infrastructure is designed for low-volume, rural traffic, would affect land use assumptions. Budget decisions made by state legislatures, which typically do not occur earlier than March, can affect funding for federally-funded and non-federally-funded projects which must be included in the emissions analysis. A decision to begin a new conformity analysis process in response to such changes could affect the region's ability to meet deadlines. In order to avoid delaying the annual approval of plan amendments and the TIP, the TPB occasionally conducts special conformity analyses for major changes which need to be addressed outside the regular annual Plan and TIP approval cycle."

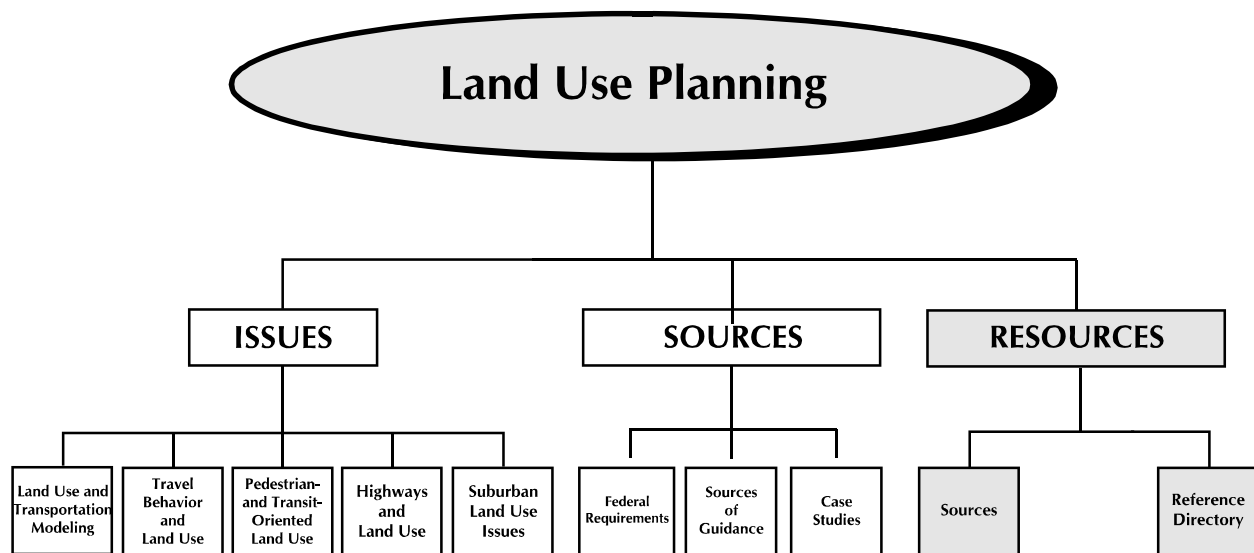
c. Travel Demand Forecasting

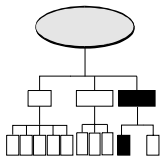
"The travel demand forecasting process begins with the development of the cooperative regional land activity forecast. This is developed through a cooperative forecasting process, managed by MWCOG, that sets a statistical benchmark for the next 25 to 30 years using an econometric model. TPB staff noted that if a local jurisdiction bases an analysis on a different forecast, the jurisdiction must defend and justify the assumptions used for its analysis. The relationships between land use and transportation policies are addressed through the cooperative forecasting process, in which the MWCOG develops region-wide and neighborhood-level forecasts for growth in employment, households, and development. The TPB reviews the preliminary forecasts and provides input to the final cooperative regional forecast."

*d. Meetings with Representatives of the General Public
and Local Elected Officials*

“Board members thought the planning process was generally positive. They noted that the process is much better at identifying issues than it is at identifying solutions. A board member noted that the process is looking at a wider variety of issues than it did prior to ISTEAs. Consideration of the relationship between transportation, air quality, land use, and environmental issues was specifically mentioned and this is consistent with ISTEAs call to broaden consideration of factors beyond simply transportation.”

Resources





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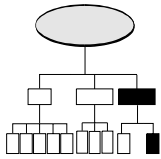
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REFERENCE DIRECTORY

Federal/National Resources

Antidotes to Sprawl Program

U.S. Environmental Protection Agency
Region 5

77 W. Jackson Blvd.

Chicago, IL 60604

Voice: (312) 353-2000

Fax: Unknown

Web Page: <http://www.epa.gov/reg5oopa/sprawl/index.html>

Brookings Center on Urban and Metropolitan Policy

1775 Massachusetts Avenue, NW

Washington, DC 20036

Voice: (202) 797-6139

Fax: (202) 797-2965

Web Page: <http://www.brookings.org/es/urban/urban.htm>

Center for Livable Communities

Local Government Commission

1414 K Street, Suite 250

Sacramento, CA 95814

Voice: (916) 448-1198

Fax: (916) 448-8246

Web Page: <http://www.lgc.org/clc>

Center of Excellence for Sustainable Development

U.S. Department of Energy

Office of Energy Efficiency and Renewable Energy

Denver Regional Support Office

1617 Cole Boulevard

Golden, CO 80401

Voice: (800) 363-3732

Fax: (303) 275-4830

Web Page: <http://www.sustainable.doe.gov/>

Congress for the New Urbanism

The Hearst Building
5 Third Street, Suite 500A
San Francisco, CA 94103
Voice: (415) 495-2255
Fax: (415) 495-1731
Web Page: <http://www.cnu.org>

Federal Highway Administration

Office of Environment and Planning
Metropolitan Planning Division, HEP-20
400 Seventh Street, SW
Washington, DC 20590
Voice: (202) 366-0182
Fax: (202) 366-3713
Web Page: <http://www.fhwa.dot.gov/environment/subject.htm>

Federal Transit Administration

Office of Planning
Metropolitan Planning Division, TPL-12
400 Seventh Street, SW
Washington, DC 20590
Voice: (202) 366-6385
Fax: (202) 366-3765
Web Page: <http://www.fta.dot.gov/office/planning/>

Growing Smart

American Planning Association
122 S. Michigan Avenue, Suite 1600
Chicago, IL 60603
Voice: (312) 431-9000
Fax: (312) 431-9985
Web Page: <http://www.planning.org/plnginfo/growsmar/gsindex.html#1>

Institute of Transportation Engineers

525 School Street, SW, Suite 410
Washington, DC 20024
Voice: (202) 554-8050
Fax: (202) 863-5486
Web Page: <http://www.ite.org>

International City/County Management Association

Smart Growth Network Member
777 North Capitol Street, NE, Suite 500
Washington, DC 20002
Voice: (202) 962-3591
Fax: (202) 962-3500
Web Page: <http://www.icma.org>

National Highway Institute

4600 N. Fairfax Drive, Suite 800
Arlington, VA 22203
Voice: (703) 235-0500
Fax: (703) 285-2791
Web Page: <http://www.nhi.fhwa.dot.gov>

National Technical Information Service

5285 Port Royal Road
Springfield, VA 22161
Voice: (800) 553-6847 or (703) 605-6000
Fax: (703) 605-6900
Web Page: <http://www.ntis.gov/index.html>

National Transit Institute

120 Albany Street, Suite 705
New Brunswick, NJ 08901-2163
Voice: (732) 932-1700
Fax: (732) 932-1707
Web Page: <http://policy.rutgers.edu/nti/>

National Transportation Library

Bureau of Transportation Statistics
400 Seventh Street, SW
Washington, DC 20590
Voice: (202) 366-1270
Fax: (202) 366-3640
Web Page: <http://www.bts.gov/ntl/>

Oregon Department of Land Conservation and Development

635 Capital Street NE, Suite 200
Salem, OR 97301
Voice: (503) 373-0050
Fax: (503) 378-6033
Web Page: <http://www.lcd.state.or.us>

Smart Growth and Neighborhood Conservation Program

Maryland Office of Planning
301 W. Preston, St.
Baltimore, MD 21201
Voice: (410) 767-4578
Fax: Unknown
Web Page: <http://www.op.state.md.us/smartgrowth>

Smart Growth Network

U.S. Environmental Protection Agency
Urban and Economic Development Division
401 M. Street, SW
Washington, DC 20460
Voice: (202) 260-2750
Fax: (202) 260-0174
Web Page: <http://www.smartgrowth.org>

Surface Transportation Policy Project

1100 17th Street, NW, 10th Floor
Washington, DC 20036
Voice: (202) 466-2636
Fax: (202) 466-2247
Web Page: <http://www.transact.org>

Technology Sharing Program

Research and Special Programs Administration, DRA-4
400 Seventh Street, SW
Washington, DC 20590
Voice: (202) 366-4978
Fax: (202) 366-3272
Web Page: <http://www.tsp.dot.gov>

Transportation Partners Program

U.S. Environmental Protection Agency
Office of Policy
401 M Street, NW
Washington, DC 20460
Voice: (202) 260-5447
Fax: Unknown
Web Page: <http://www.epa.gov/tp/>

Transportation Research Board

National Academy of Sciences / National Research Council
2101 Constitution Ave., NW
Washington, DC 20418
Voice: (202) 334-2933
Fax: (202) 334-2003
Web Page: <http://www.nas.edu/trb/>

Travel Model Improvement Program

Texas Transportation Institute
110 North Davis Drive, Suite 101
Arlington, TX 76013
Voice: (817) 277-5503
Fax: (817) 277-5439
Web Page: <http://www.bts.gov/tmip/tmip.html>

Trust for Public Land

116 New Montgomery Street, 4th Floor
San Francisco, CA 94105
Voice: (415) 495-4014
Fax: (415) 495-4103
Web Page: <http://www.tpl.org>

Urban Land Institute

1025 Thomas Jefferson Street, NW, Suite 500W
Washington, DC 20007
Voice: (800) 321-5011
Fax: (202) 624-7140
Web Page: <http://www.uli.org>

Case Study MPOs

NOTE: Links to multiple TIPs and LRTPs are available on-line at the National Transportation Library
[\[http://www.bts.gov/ntl/subjects/statements.html\]](http://www.bts.gov/ntl/subjects/statements.html).

Chicago

Chicago Area Transportation Study
300 West Adams
Chicago, IL 60606
Voice: (312) 793-3456
Fax: (312) 793-3481
Web Page: None

Dallas

North Central Texas Council of Governments
616 Six Flags Drive
PO Box 5888
Arlington, TX 76005-5888
Voice: (817) 695-9150
Fax: Unknown
Web Page: <http://www.nctcog.dst.tx.us>

Honolulu

Oahu Metropolitan Planning Organization
Ocean View Center
707 Richards Street, Suite 200
Honolulu, HI 96813
Voice: (808) 587-2015
Fax: (808) 587-2018
Web Page: <http://www.eng.hawaii.edu/~csp/OMPO/ompo1.html>

Miami

Miami Urbanized Area Metropolitan Planning Organization
c/o Office of the County Manager
111 NW First Street, Suite 910
Miami, FL 33128
Voice: (305) 375-4507
Fax: Unknown
Web Page: None

New Orleans

Regional Planning Commission for
Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany Parishes
333 St. Charles Avenue, Suite 1100
New Orleans, LA 70130
Voice: (504) 568-6611
Fax: (504) 568-6643
Web Page: <http://www.gnofn/~rpc/>

Northern New Jersey

North Jersey Transportation Planning Authority
One Newark Center, 17th Floor
Newark, NJ 07102
Voice: (973) 639-8400
Fax: (973) 639-1953
Web Page: <http://njtpa.njit.edu>

Philadelphia

Delaware Valley Regional Planning Commission
The Bourse Building
111 South Independence Mall East
Philadelphia, PA 19106-2515
Voice: (215) 592-1800
Fax: (215) 592-9125
Web Page: <http://www.dvrpc.org>

Salt Lake City

Wasatch Front Regional Council
420 West 1500 South #200
Bountiful, UT 84010
Voice: (801) 292-4469
Fax: Unknown
Web Page: <http://www.wfrc.org>

San Francisco

Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607
Voice: (510) 464-7700
Fax: (510) 464-7848
Web Page: <http://www.mtc.dst.ca.us>

Seattle

Puget Sound Regional Council
1011 Western Avenue, Suite 500
Seattle, WA 98104-1035
Voice: (206) 464-7090
Fax: (206) 587-4825
Web Page: <http://www.psrc.org>

Washington, DC

Metropolitan Washington Council of Governments
777 North Capitol Street, NE
Suite 300
Washington, DC 20002-4239
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Fax: (202) 962-3201
Web Page: <http://www.mwcog.org>